LIBRARY OF CONGRESS, COPYRIGHT MAY 7 1888 CITY OF WASHINGTON 540

PRICE 15 CENTS

MAY 5, 1888.

THE AMERICAN ARCHITECT AND BUILDING NEWS

VOL. XXIII. REGULAR EDITION NO. 645.

ARCHITECTURE

ENGINEERING

DECORATION

CONSTRUCTION

TICKNOR & COMPANY

BOSTON MASS.

CONTENTS.

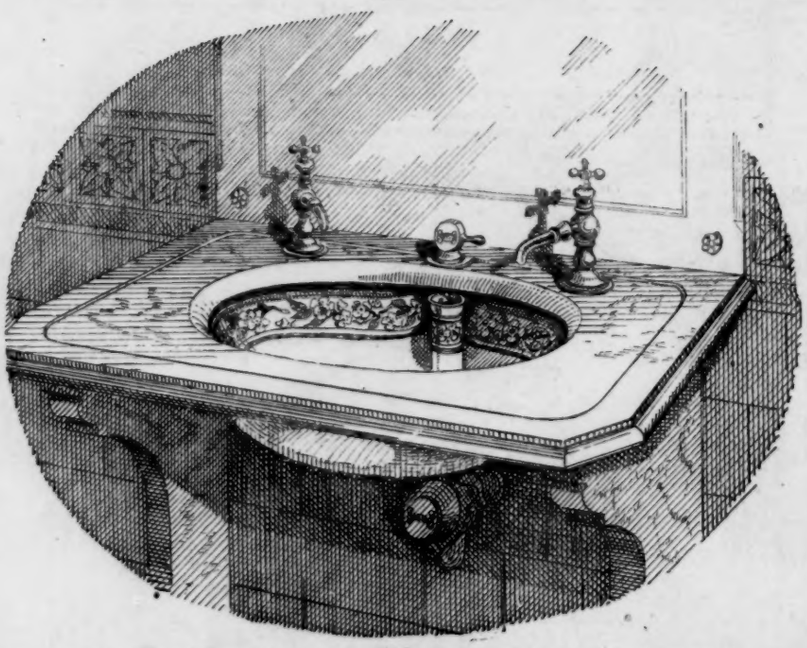
Editorial Summary.
Safe-Building.—XXV.
United States Government Building Practice.—X.
General Q. A. Gillmore.
Street-Watering with Sea-water.
Estimates.
Carolina Clay-eaters.
A Celebrated Art Manufacturer.
Communications.
Notes and Clippings
Trade Surveys.

ILLUSTRATIONS.

House of J. C. Abbott, Esq., Montreal, Canada.
(Gelatine Print issued only with Imperial Edition.)
Sketch for an Artist's Country House.
House, Cambridge, Mass.
Design for Congregational Church.
Church at Dublin, N. H.
Building for the Pioneer Press, St. Paul, Minn.
Plans for Apartment-houses
Study for a Store Building.

THE SANITAS LAVATORIES.

(BASIN, BATH-TUB, PANTRY-SINK.)



THE SANITAS PATENT WASH-BASIN.

Quick emptying with a stand-pipe overflow. These fixtures discharge very rapidly, scouring the trap and waste-pipes. The overflow pipe stands in a recess in the back of the fixture, and does away with the ordinary foul secret overflow passage, and the troublesome and dirty plug and chain. A single motion of the hand opens or shuts the outlet. By this device the utmost simplicity, convenience, and cleanliness are obtained. The stand-pipe may be readily detached from the lifting device to facilitate burnishing or scrubbing. The Sanitas basin stand-pipe is made either of brass or earthenware. When made of earthenware like the basin itself all visible submerged metal work and consequent burnishing is avoided, and the stand-pipe admits of colored decoration like the basin itself, producing with the latter an ornamented effect altogether original and unsurpassed.

Ordinary lavatories have outlets so contracted that they discharge a stream in size scarcely a tenth of the capacity of their waste-pipes. The result is a gradual accumulation of filth therein and a highly unsanitary condition of affairs. No trap or even straight pipe, whether vented or unvented can be kept clean under such lavatories. The Sanitas Lavatories on the contrary fill the pipes "full-bore" and strongly scour them.

Beware of infringements which are inferior as well as illegal. Accept only the genuine and original standpipe lavatories which are stamped with the name "Sanitas."

THE SANITAS MANUFACTURING COMPANY,

MAIN OFFICE: 207 TREMONT STREET, BOSTON, MASS.

BRANCH OFFICE: 92 BEEKMAN ST., NEW YORK, N. Y.; 47 TO 49 DEARBORN ST., CHICAGO, ILL.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXIII. Copyright, 1888, by TICKNOR & COMPANY, Boston, Mass. No. 645.

MAY 5, 1888.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

SUMMARY: —
The Question of the New York Criminal Courts Building and Hall of Records. — Holy Trinity Church *vs.* the Imported Contract Labor Law. — How a New England Town secures Sewerage. — The Late W. E. Nesfield, Architect. — The Episcopal Cathedral, New York. — Responsibility of Contractors: an English Case. — An Englishman's Idea of what a Poor Man's Cottage should be. 205
SAFE BUILDING. — XXV. 207
ILLUSTRATIONS: —
House of J. C. Abbott, Esq., Montreal, Canada. — Sketch for an Artist's Country House. — House for Henry Endicott, Esq., Cambridge, Mass. — Design for Congregational Church, Elizabethtown, N. Y. — Church at Dublin, N. H. — Building for the *Pioneer Press*, St. Paul, Minn. — Plans for Apartment-houses. — Study for a Store-building, St. Paul, Minn. 210
UNITED STATES GOVERNMENT BUILDING PRACTICE. — X. 210
GENERAL Q. A. GILLMORE. 212
STREET WATERING WITH SEA-WATER. 213
ESTIMATES. 214
CAROLINA CLAY-EATERS. 214
A CELEBRATED ART MANUFACTURER. 215
COMMUNICATIONS: —
The American Public Health Association. — The Cost of Small Houses in Paris. — Mr. Tarver's Theatre Plans. — Building-Movers. 215
NOTES AND CLIPPINGS. 216
TRADE SURVEYS. 216

THE important competition for the criminal court-building and record-hall in New York has had a singular result. It will be remembered that the local bodies of architects almost unanimously condemned the terms of competition, but a considerable number of drawings was received, which are, we believe, still under consideration by the judges. Meanwhile, however, a bill was introduced in the New York State Legislature, which has just been unanimously passed, absolutely forbidding the erection of either of the proposed buildings in the place assigned by the terms of competition, so that the costly contest will, apparently, have no practical result. It is only fair to the New York municipal authorities to say that they seem to have intended to make their terms of competition acceptable to architects, so far as they could without committing themselves to the actual erection of the buildings, about which they probably felt an uncertainty; but now that the Legislature has converted the uncertainty into a positive prohibition, it will occur to a good many people that the whole affair would have presented a better appearance if the matter of the site had been settled before any further steps were taken, so that architects might have been invited to compete by the only inducement which will tempt the better class of them, the definite promise of the execution of his design, at the usual remuneration, to the author of the best plan. The next thing for the city to do would seem to be the selection of a new site, more acceptable to the Legislature, for the buildings, which have become very necessary to the municipal business. As the legislative bill forbids their erection on any part of the City-hall Park, and as it is desirable that they should be in the neighborhood of the present City-hall and Court-house, the requirements can hardly be fulfilled without condemning private land in the vicinity, and clearing it. As all the land near is covered with very costly buildings, the expense of a suitable site will be enormous. The *Mail and Express* suggests that the estates on the west side of Broadway, between Warren Street and Park Place, should be taken, leaving communication between Murray Street and Broadway by a large arch, and on the whole, although rather startling, this seems to us about as judicious a plan as is likely to be proposed. Although the Broadway land is probably more valuable than that on the other sides of the City-hall Park, the buildings on the portion to be taken are not so costly as the enormous office-buildings on the other sides of the Park, while the convenience and magnificence of the Broadway site are worth a considerable additional cost. With the arch, forming the terminus of Murray Street, somewhere in the middle of a façade five or six hundred feet in length, an effect would be obtained which would be conspicuous for a long distance in three directions, and would represent, as nothing in New York, except the Central Park, now does, the greatness of the first of American cities. If we had our way, perhaps, we should clear the whole end of the island, south of Rector Street, and build a splendid group of municipal buildings, which should not only form a worthy termination to all the railway lines, but should present to persons arriving by sea the most splendid architectural scene in the world; but as there is no probability that a building on which so many millions were lavished as the County Court-house would ever be moved or abandoned, no doubt the *Mail and Express*'s scheme is the best suited to the circumstances.

THE case of Holy Trinity Church in New York, which has been arraigned for violation of the Foreign Contract Labor law in calling an English rector to the parish, is now on trial in New York. Of course, the question to be tried is simply whether the law applies to the hiring of clergymen, as well as of spinners and foundry-men, and the opinion of the judges will be of considerable interest, particularly as a somewhat similar case was recently tried in California, where a Chinese professor, who had been appointed, was held not to be liable to the operation of the law, which, it was there said, was obviously intended to apply only to manual laborers. We imagine that the New York courts are rather slower than most others to discover "obvious intent" in statutes which cannot be interpreted by the aid of the dictionary; and as the law expressly exempts from its operation "professional artists, actors, lecturers and singers," the presumption is that it intended to exempt no other persons; and clergymen being neither artists, actors, lecturers nor singers, the unavoidable inference is that they are not exempt from its operation, as it now stands, however disposed counsel or judges may be to correct and amend it on their own account, by supplying such "obvious intents" as may suit their varying ideas of expediency. In point of fact, as the United States District Attorney in the case well remarked, the law, as passed, was a crude and contemptible electioneering device, put forth with the idea of catching the votes of labor agitators, and enacted by the votes of Congressmen who, apparently, never read anything of it beyond the title. For all that, however, it is the law of the United States to-day, and if we choose to elect Congressmen who pass laws of that sort, the best thing that the courts can do for us is to see that they are literally and strictly enforced.

WE commend to the citizens of the many towns, particularly in the Eastern States, which refuse year after year, to take the simplest measures for preventing pollution of the soil by increasing population, or to pay the slightest attention to any other measures of hygiene, the example of some inhabitants of Winthrop, Mass., who, having petitioned and agitated for years in vain for the adoption of some system of sewerage in the most thickly settled portion of the place, have now caused a bill to be introduced in the Massachusetts Legislature, under which the sluggish municipality is to be required to furnish within twelve months the sewerage asked for, with the alternative, if the order is not complied with, of having the work done under direction of the State Board of Health, at the expense of the town. There is said to be no doubt that the bill will pass the Legislature, and Winthrop will have to make itself partly clean, whether it wishes to do so or not. It is much to be hoped that the example will be followed by the residents of many other small New England cities. Curiously enough, the inhabitants of these communities, though very heavily taxed, get less for their money in the way of decency than any others in the United States. It has long been the fashion in New England to satirize the neglected, shabby look of Southern towns; yet there are few Southern towns which do not show more solicitude for public health, and more efficiency in providing for it, than some New England cities of twice the population, and five times the wealth.

AMONG the best trained and most artistic English architects, no one will be more seriously missed and more deeply regretted, than Mr. W. Eden Nesfield, who died a few weeks ago, at the age of fifty-three. Most of us are familiar with Mr. Nesfield's beautiful book of sketches from the Continent, which was published some fifteen years ago, at the same time with a similar book by his intimate friend and associate, Mr. Norman Shaw. Of the two books, perhaps Mr. Nesfield's was a little the more beautiful, but the talent of the authors ran in directions very similar, and their work, on commencing practice, showed very much the same common sympathy. Like the late William Burges, however, Mr. Nesfield possessed an independent fortune, and, not being obliged to exercise his gifts for a livelihood, and being also very averse to professional notoriety, or "advertising," as he called it, his buildings are not very numerous, and are little known. Of late years, says the *Builder*, he had practically retired altogether from professional work, and had devoted himself to painting, which he considered the means of artistic expression most suited to him. Most people will think that the great capacity for artistic expression in stone and timber which he possessed was too rare a gift to be abandoned, but it is hardly to be wondered at that a man of sensitive disposition, with the means of pleasing himself in the matter, should be glad to give up the annoyances and anxieties of architectural practice for quiet work at his easel. In private life Mr. Nesfield was always kind and helpful to his brother architects, and his name will be long cherished in the profession in England.

THE project for a great Episcopal Cathedral in New York is developing rapidly. The splendid site on Morningside Park has been secured, and arrangements have been made for obtaining preliminary designs. According to the New York *Times*, an "architectural expert" has been in correspondence with "architects of renown" in all parts of the civilized world in regard to plans, while the Trustees, according to the same journal, find themselves embarrassed by the consideration that "in the Middle Ages men of genius devoted their entire lives to the building of the great cathedrals," receiving for the sacrifice "a moderate compensation, if any," and that at the present time the men of genius are busy building "railways, bridges, bank buildings and life-insurance buildings," that pay them much better than the Cathedral Trustees can afford to. The *Tribune* reporter seems to have found a Trustee in a more cheerful mood, for his account makes no mention of the very unfounded notion that the mediæval architects devoted their lives to one building, or that they were poorly paid for their work, and says that within a week or so invitations will be sent out to the leading American architects for sketches, two of which are to be selected "as a basis to work on." Just what this means we cannot imagine, but suppose that the circular, when it appears, will throw some light on the subject. Another interesting piece of news is that Trinity School is to purchase a portion of the Cathedral plot, and erect its buildings in connection with those of the Cathedral. If, as we hope will be the case, the school buildings are to be joined in the same design with the Cathedral, a very effective group might easily be made. As the school has a large endowment, this portion of the structure can be built as soon as the ground is clear. The Cathedral, however, is likely to be a longer affair, and it is proposed to build the choir first, consecrate and use it, adding the rest later, as has been done at St. Thomas's, in New York, and several other parish churches, to say nothing of such examples as the Cathedrals of Cologne and Beauvais.

A CASE was recently tried in England involving the responsibility of contractors, which we find reported in the *Builder*. The Messrs. Peto Brothers, very eminent builders in London, had a contract for the erection of a hotel in Covent Garden. In carrying out their contract, they were obliged to excavate about nine feet below the foundation of the wall, between the hotel and the adjoining house and underpin the wall. In doing so, the wall was cracked from top to bottom. The owner of the adjoining estate sued the Messrs. Peto for damage to his wall. The contractors resisted on the ground that the work which they had done was carried out under the provisions of the Metropolitan act, and that the settlement and cracking of the superstructure was an inevitable consequence of the underpinning, and they argued that the work having been done in accordance with the statute, no one could be held liable for the result of it; that if any one could be held liable, it was the owner of the building they had constructed and not themselves, and finally, that the work had been carried out with the utmost care, and that, as the cracking was unavoidable under any circumstances, there had been no negligence involving anybody's responsibility. The defendants did not call any witnesses to prove their assertion that the cracking of the wall was the necessary consequence of underpinning it, and his lordship, the judge, remarked that if all the builders in London had come and said so he should not believe them. In his opinion there had been very considerable negligence. He was sure that the settlement was not the inevitable result of the work done, because he had himself seen a wall underpinned without producing any cracks, so that the damage not being the necessary consequence of work done according to the statute, the defendants could not use that for avoiding their responsibility, and for much the same reason, the burden could not be shifted on the shoulders of their employer. No one remained to bear it except the builders, and the judge condemned them to pay the assessed damage to the wall, about two hundred dollars, with two hundred and fifty more as consolation to the owner of the injured house, and the costs of the suit.

THE *Sanitary News* contains an interesting article on cottage construction by Mr. J. Corbett, the author of a prize essay on the best means of providing dwellings for the poorer classes of Central London. According to Mr. Corbett, the best models for English cottages are to be found, like those for more ambitious dwellings, among the structures of a past generation, perhaps of the Elizabethan age. In his perfect cottage there should be no shabby imitation of a superior architecture, no fragile iron or slender woodwork, no weak and diseased plastering, creaking and shaky floors, or concealed hollow spaces for the accommodation of dust and vermin. He would have his little house plain and simple, but substantial in every detail, dry, sunny and clean. To secure this the walls should be faced with hard-burned bricks, not disposed to absorb water, or, if these cannot be obtained, the outside should be treated with two coats of boiled linseed oil, laid on hot at a season when the walls are dry, or washed with two coats of thin Portland cement, tinted, if desired, to any required shade. As an additional protection against dampness, the inside should be plastered directly on the brickwork with cement instead of lime-mortar, and the roof should overhang the walls at least one-twentieth of the height of the walls. This amount of projection, according to Mr. Corbett, will keep about nine-tenths of the rainfall from reaching the walls. For floors in rooms so small as those of cottages, where the span seldom exceeds twelve feet, he would use solid planks, three or four inches thick, tongued and grooved or splined together and bolted through. The ends of the planks would rest on projecting courses of brick arranged for the purpose, and the crevices between them and the walls should be filled up with cement. In Mr. Corbett's opinion, such floors would be more sound-proof than the ordinary hollow flooring. We may be permitted to doubt this, but they would certainly be very substantial and durable and, in consequence, architecturally satisfactory. In the vicinity of large manufactories he would provide for supplying a limited amount of steam to each cottage, introducing it between the double walls of an oven in such a way that in cold weather the radiation from the oven would warm the room in which it stood, while the interior of the oven could be utilized at any moment for warming a breakfast, cooking a dinner, heating water for bathing, or disinfecting clothing. This seems to us an excellent suggestion. One of the most sensible men we ever knew once remarked to us that intemperance among the poor was chiefly due to dyspepsia. They had to live on cold, indigestible food, which kept their stomachs disordered, and, through the well-known sympathy between the stomach and the brain, the pangs of imperfect nutrition engendered a melancholy and uneasiness which craved alcohol for temporary relief. There is certainly a good deal of reason in this, and an arrangement so simple as that described by Mr. Corbett, which might be provided for an entire factory village at small expense, would secure warm, well-cooked breakfasts and suppers for the men of the little households, which would send them off to their work in the morning in a comfortable frame of mind and body, and would attract them home at night, without overtaxing the strength of the mothers, already tired, perhaps, by the care of a nursing baby and two or three other children.

SAFE BUILDING. — XXV.[1]

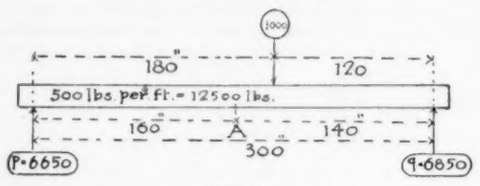


Fig. 148.

Explanation of Tables XIX to XXIII. TABLE XIX gives all the necessary data in regard to the different shapes of wrought-iron and steel I-beams, and Tables XX, XXI, XXII, and XXIII of channels, angles, tees, etc., which are rolled. The sections selected are those of the New Jersey Steel and Iron Company. The sections of the other companies are essentially the same. The strengths of some of the I-beams and channels of this Company, however, are a trifle stronger and stiffer than those of some of the other companies, as they are a fraction of an inch deeper, though of the same weight and area of cross-section. It should be remarked that except in the case of the simplest kind of beam work, it is cheaper to frame up plate girders, or trusses of angles, tees, etc., as there is a strong pool in the rolling of I-beams and channel sections, which keeps the price of these two sections unreasonably high, in proportion to other rolled sections. Steel beams and sections are sold as cheap as iron, (they are really cheaper to manufacture), and where their uniformity can be relied on, should be used in preference, as they are much stronger and also a trifle stiffer.

I-sections not economical.

One example of an iron beam will make the application of the Tables to transverse strains clear, and help to review the subject, before taking up the graphical method of calculating transverse strains.

Example.

Use of Table XIX. *A wrought-iron I-beam of 25-foot clear span, carries a uniform load of 500 pounds per foot including weight of beam; also a concentrated load of 1000 pounds 10 feet from the right hand support. The beam is not supported sideways. What size beam should be used?*

The total uniform load $u = 500.25 = 12500$ pounds of which one-half or 6250 pounds will go to each reaction; of the 1000 pounds load $\frac{180}{300}$ or 3-5 will go to the nearer support q (Formula 15), therefore

$$q = 6250 + \tfrac{3}{5}.\ 1000 = 6850$$

Similarly we should have (Formula 14)

$$p = 6250 + \tfrac{2}{5}.\ 1000 = 6650$$

As a check the sum of the two loads should $= 13500$, and we have, in effect:

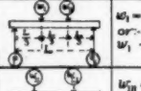
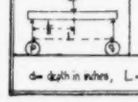
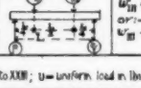
$$6850 + 6650 = 13500$$

To find the point of greatest bending moment begin at q pass to load 1000, and we will have passed over ten feet of uniform load or 5000 pounds, add to this the 1000 pounds making 6000 pounds, and we still are 850 pounds short of the reaction, we pass on therefore towards p one foot, which leaves 350 pounds more, and pass on another 7-10 of a foot (to A) which very closely makes the amount. The point of greatest bending moment therefore is at A, say 1′ 8″ to the left of the weight, or 140″ from q: As a check begin at p and we must pass along 160″ or 13′ 4″ of uniform load before reaching the point A, at 500 pounds a foot this would make $13\frac{1}{3}.500. = 6666$ or close enough to amount of reaction p for all practical purposes.

TABLE XIX — LIST OF TRENTON I-BEAMS.

Depth of Beam. (d)	Weight Per Yard.	Width of Flanges. (b)	Thickness of Web.	Area of each Flange	Area of Web.	Total Area. (a)	Axis Normal to Web. M---N: Moment of Inertia. (I)	Moment of Resistance. (r)	Square of Radius of Gyration. (ρ^2)	Transverse Value (v) in lbs.: For Iron.	For Steel.	Axis Parallel to Web. M---N: Moment of Inertia. (I)	Moment of Resistance. (r)	Square of Radius of Gyration. (ρ^2)	Transverse Value (v) in lbs.: For Iron.	For Steel.
20″	272	6 3/4	11/16	6.725	13.79	27.20	1830.3	183.0	60.67	1320000	1650000	46.90	13.78	1.71	110000	137800
20″	200	6	1/2	4.985	10.00	19.97	1238.0	123.8	61.99	990000	1230000	26.62	8.87	1.33	71000	88700
15½″	200	5 3/4	0.6	5.479	9.07	20.02	707.1	93.5	35.32	748000	935000	27.46	9.55	1.37	76000	95000
15½″	150	5	1/2	3.725	7.89	15.04	543.3	69.0	34.80	552000	690000	19.19	6.12	1.02	49000	61200
15″	125	5	0.42″	3.005	6.35	12.36	454.5	57.5	33.18	460000	575000	11.64	4.66	0.94	32000	46600
12½″	170	5 1/2	0.6″	4.690	7.39	16.77	391.2	63.5	23.32	508000	635000	28.41	8.24	1.52	74000	92400
12″	125	4.79	0.47″	3.290	5.75	12.33	266.0	47.0	23.39	376000	470000	11.51	4.82	0.93	38900	48200
12″	120	5 1/2	0.39″	3.525	4.68	11.73	281.3	46.9	23.98	375000	469000	16.76	6.10	1.45	49000	61000
12″	96	5/4	3/6	2.810	3.84	9.44	229.2	38.2	24.22	306000	382000	11.66	4.44	1.23	35500	44400
10½″	135	5	0.47	4.215	4.93	13.36	253.7	44.9	17.49	396000	445000	13.80	6.32	1.18	50300	63200
10½″	105	4 1/2	3/6	3.215	3.93	10.44	185.6	33.3	17.77	282000	353000	8.23	4.19	0.90	33100	41300
10″	90	4 1/2	3/6	2.810	3.38	8.90	164.0	31.2	18.42	250000	312000	8.09	3.89	0.91	25700	32000
9″	125	4 1/2	0.57	3.600	5.13	12.33	150.8	33.6	12.23	268000	335000	11.23	4.99	0.91	40000	49900
9″	85	4 1/2	3/6	2.580	3.38	8.50	111.9	24.9	13.16	199000	249000	7.38	3.27	0.86	26000	32700
9″	70	4	0.3	2.150	2.70	7.00	93.9	20.9	13.41	167000	209000	4.92	2.46	0.70	19700	24600
8″	80	4 1/2	3/6	2.635	2.94	8.03	83.9	21.0	10.44	168000	210000	7.63	3.39	0.93	26600	33300
8″	65	4	0.3	1.985	2.40	6.37	67.4	16.9	10.56	135000	169000	4.65	2.27	0.71	16200	22700
7″	55	3 3/4	0.3	1.700	2.10	5.50	44.3	12.7	8.05	101000	127000	3.60	2.08	0.71	16600	20800
6″	120	5 1/4	4/6	4.045	3.75	11.84	64.9	21.6	5.46	172000	216000	18.59	7.08	1.57	56400	70600
6″	90	5	1/2	2.890	3.00	8.78	49.8	16.6	5.72	132000	166000	10.78	4.32	1.24	34600	43200
6″	50	5 1/2	0.3	1.335	1.80	4.81	29.0	9.6	5.90	76800	96000	2.74	1.57	0.84	12500	15700
5″	40	5	1/4	1.255	1.50	4.01	23.8	7.6	5.86	62400	78000	1.61	1.07	0.40	8600	10700
5″	40	5	5/16	1.170	1.56	3.90	15.4	6.1	3.95	48800	61000	1.68	1.12	0.43	9000	11200
5″	30	2 3/4	1/4	0.895	1.20	2.99	12.1	4.8	4.04	38400	48000	1.04	0.76	0.38	6000	7600
4″	37	3	5/16	1.205	1.28	3.66	9.2	4.6	2.51	36800	46000	1.74	1.16	0.48	9300	11600
4″	30	2 3/4	1/4	0.955	1.00	2.91	.7.5	3.75	2.47	30000	37500	1.11	0.81	0.38	6000	8100
4″	18	2	5/16	0.510	0.78	1.77	4.5	2.25	2.54	18000	22500	0.31	0.31	0.175	2500	3100
1½″	3½	1/2	1/6	0.185	0.16	0.62	0.135	0.21	0.26		2160	0.069	0.092	0.013		920

HOW TO USE TRANSVERSE VALUE (*v*) FOR BEAMS BRACED SIDEWAYS

Manner of Loading	To Obtain Safe Load in lbs.	Length of Span not to crack plastering must not exceed. For Iron.	For Steel.	Greatest Actual Deflection will be. For Iron.	For Steel.	Manner of Loading	To Obtain Safe Load in lbs.	Length of Span not to crack plastering must not exceed. For Iron.	For Steel.	Greatest Actual Deflection will be. For Iron.	For Steel.
	$u = \frac{v}{L}$	$L = 2\frac{1}{2}d.$	$L = 2\ d$	$\delta = \frac{L^3}{75.d}$	$\delta = \frac{L^3}{64\frac{1}{2}.d}$		$w_1 = w_2 = \frac{v}{2\frac{1}{2}L}$ or: $w_1 + w_2 = \frac{v}{1\frac{1}{2}L}$	$L = 2\frac{5}{16}d$	$L = 1\frac{3}{4}d$	$\delta = \frac{L^3}{72\frac{1}{2}.d}$	$\delta = \frac{L^3}{62\frac{1}{2}.d}$
	$w = \frac{v}{2\ L}$	$L = 2\frac{1}{2}d$	$L = 2\frac{1}{2}d$	$\delta = \frac{L^3}{93\frac{1}{2}d}$	$\delta = \frac{L^3}{80\frac{1}{2}d}$		$w'_m = w''_m = \frac{v}{2\ L}$ or: $w'_m + w''_m = \frac{v}{L}$	$L = 2.d$	$L = 1\frac{3}{4}d$	$\delta = \frac{L^3}{69.d}$	$\delta = \frac{L^3}{57\frac{1}{2}.d}$

d = depth in inches, *L* = length in feet, δ = deflection in inches; *v* = transverse value as given in tables XIX to XXIII; *u* = uniform load in lbs.; *w* = centre load in lbs.; $w_1 = w_2$ also $w'_m = w''_m$ = concentrated loads in lbs.

NOTE. — If the transverse values (*v*) — given for steel — are used, test each piece carefully, as steel varies greatly in strength. For *equal* deflections of steel and iron, add only 7½% to iron transverse values, instead of 25% as given in tables.

GLOSSARY OF SYMBOLS. — The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
$\mathfrak{D}$ = *diameter*, in inches.
$\mathfrak{r}$ = *radius*, in inches
π = 3.14159, or, say, 3 1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

[1] Continued from No. 641, page 164.

The uniform load per inch will be $\frac{500}{12} = 41\frac{2}{3}$ pounds.

Now the bending moment at A will be, taking the right-hand side (Formula 24)

$$M_A = 6850.140 - 41\frac{2}{3}.140.70 - 1000.20$$
$$= 530\,667 \text{ pounds-inch.}$$

As a check take the left-hand side (Formula 23)

$$M_A = 6650.160 - 41\frac{2}{3}.160.80$$
$$= 530614 \text{ pounds-inch, or near enough alike for all practical purposes.}$$

Now the safe modulus of rupture for wrought-iron (Table IV) is $\left(\frac{k}{f}\right) = 12000$ pounds, therefore the required moment of resistance r from Formula (18)

$$r = \frac{530667}{12000} = 44,2$$

Looking at the Table XIX we find the nearest moment of resistance to be 46,8 or we should use the $12'' - 120$ pounds per yard I-beam. But the beam is unsupported sideways. The width of top flange is $b = 5\frac{1}{2}''$. We now use Formula (78) to find out how much extra strength we require.

Reduction for Lateral Flexure. In inserting value for y, we use the second column of Table XVI, as the beam is, of course, of uniform cross-section throughout, and have

$$y = 0,0192.$$

In place of w we can insert the actual value r of the beam, and see what proportion of it is left to resist the transverse strength, after the lateral flexure is attended to,

$$\text{or } r_1 = \frac{r}{1 + \frac{0,0192.25^2}{5\frac{1}{2}^2}} = \frac{r}{1 + 0,3966} \text{ or}$$

TABLE XX.—LIST OF CHANNELS.

Depth of Channel (d)	Weight Per Yard	Width of Flange. (b)	Thickness of Web.	Area of each Flange	Area of Web.	Total Area (a)	Axis Normal to Web. M—N: Moment of Inertia. (I)	Moment of Resistance. (r)	Square of Radius of Gyration. (ρ^2)	Transverse Value (v) in lbs. For Iron.	For Steel.	Axis Parallel to Web. M—N: Moment of Inertia. (I)	Moment of Resistance. (r)	Square of Radius of Gyration (ρ^2)	Distance of Neutral Axis from Back of Web.	Transverse Value (v) in lbs. For Iron.	For Steel.
15"	230	5 3/4"	1 1/16"	5.09	12.82	23.00	66.07	88.09	28.73	705000	881000	37.56	10.05	1.63	1.28	80500	100500
15"	190	4 3/4"	3/4"	4.77	9.46	19.00	58.60	78.13	30.84	625000	781300	32.25	9.24	1.70	1.26	74000	92400
15"	195	4 1/2"	1"	5.00	13.80	19.50	51.66	68.88	26.49	551000	688800	18.73	5.34	0.96	0.99	43000	53400
12 1/2"	170	4 1/16"	1"	3.63	8.74	17.00	37.60	50.13	31.33	401000	501300	14.47	4.74	1.21	0.95	38000	47400
12 1/2"	140	4"	11/16"	3.52	6.96	14.00	29.16	47.64	29.03	381000	476400	11.87	6.25	1.26	1.12	49600	62000
12 1/2"	140	3 5/16"	0.9"	2.13	9.74	14.00	24.05	39.26	17.18	314000	392500	7.14	2.59	0.51	0.805	30700	25900
12 1/2"	70	3"	0.55"	1.72	3.56	7.00	15.32	25.03	21.89	200000	250300	5.04	2.24	0.72	0.755	18000	22400
10 1/2"	105	3 1/16"	0.8"	1.50	7.50	10.50	12.94	24.64	12.32	197000	246400	4.96	1.98	0.47	0.69	16000	19800
10 1/2"	60	2 1/4"	5/8"	1.24	3.52	6.00	8.84	16.84	14.75	134700	168400	3.64	1.81	0.64	0.628	14500	18100
10"	92	2 15/16"	3/4"	1.16	6.84	9.20	10.05	20.10	10.92	161000	201000	3.02	1.51	0.33	0.626	10500	13100
9"	40	2 1/2"	5/16"	0.97	2.56	4.80	6.40	12.80	13.33	102400	128000	2.20	1.19	0.46	0.565	9100	11400
9"	109	3 5/16"	7/8"	2.17	6.56	10.90	10.87	24.16	9.97	193300	241600	7.30	2.75	0.67	0.81	22000	27500
9"	70	3 1/8"	7/16"	1.66	3.28	7.00	8.21	18.24	11.73	146000	182400	5.35	2.53	0.76	0.85	18800	23500
9"	70	2.79"	5/8"	1.41	4.86	7.70	7.67	17.04	9.96	136300	170400	3.25	1.51	0.43	0.65	12100	15100
8"	24	2.86"	3/8"	1.61	4.18	7.40	6.01	15.03	8.12	120200	150300	3.53	1.35	0.51	0.63	10800	13500
8"	45	2 1/2"	0.26"	1.38	1.74	4.50	4.45	11.12	9.89	89000	111200	2.54	1.46	0.56	0.76	11700	14600
8"	62	2 7/16"	3/16"	1.15	3.96	6.20	4.84	12.10	7.81	97000	121000	1.94	0.96	0.31	0.564	7840	9800
7"	55	2.2"	0.2"	0.96	1.38	3.30	3.29	8.22	9.97	65700	82200	1.44	0.89	0.44	0.580	7120	8900
7"	54	2 3/4"	1/2"	1.23	2.94	5.40	3.42	9.77	6.33	78000	97700	2.33	1.22	0.47	0.684	9760	12200
7"	36	2 1/2"	1/4"	1.07	1.46	3.60	2.71	7.74	7.53	62000	77400	1.96	1.10	0.54	0.715	8800	11000
7"	46	2.29"	0.49"	0.78	3.04	4.60	2.56	7.31	5.57	58500	73100	1.11	0.62	0.24	0.506	4960	6200
7"	20.2	2"	0.2"	0.66	1.23	2.53	1.73	4.94	6.78	39500	49400	0.83	0.56	0.33	0.511	4500	5600
6"	66	2.85"	3/4"	1.52	3.56	6.60	2.80	9.33	4.24	74600	93300	2.95	1.43	0.45	0.786	14300	14300
6"	40	2 1/2"	0.4"	1.50	1.90	4.80	2.17	7.23	4.82	58000	72500	2.12	1.20	0.47	0.725	9600	12000
6"	54	2.6"	9/16"	1.16	3.08	3.40	2.34	7.80	4.55	62400	78000	1.84	0.95	0.34	0.647	7600	9500
6"	35	2 1/4"	0.26"	0.96	1.88	3.50	1.72	5.73	5.21	46000	57300	1.30	0.80	0.39	0.630	6400	8000
6"	45	2 1/4"	9/16"	0.81	2.88	4.50	1.95	6.50	4.85	52000	65000	1.03	0.61	0.25	0.556	4880	6100
6"	22.8	1.78"	0.16"	0.66	0.93	2.25	1.26	4.20	5.60	33600	42000	0.70	0.52	0.31	0.540	4160	5200
5"	34	1.92"	7/8"	0.65	2.10	3.40	1.05	4.12	3.03	33000	41200	0.65	0.44	0.19	0.493	3520	4400
5"	19	1.56"	0.2"	0.55	0.64	1.90	.72	2.88	3.80	23000	28800	0.44	0.36	0.23	0.469	3010	3800
4"	29	1.61"	0.51"	0.64	1.62	2.90	.56	2.80	1.93	22400	28000	0.49	0.38	0.17	0.504	3040	3800
4"	16.2	1.12"	0.2"	0.51	0.63	1.65	.38	1.95	2.36	15600	19500	0.32	0.31	0.19	0.460	2480	3100
3"	25	1.65"	0.53"	0.67	1.16	2.50	.27	1.80	1.08	14400	18000	0.47	0.37	0.19	0.358	2360	3700
3"	13	1.12"	0.2"	0.53	0.49	1.30	.20	1.33	1.33	10640	13300	0.29	0.28	0.19	0.510	2520	2960

For Use of Transverse Values, also Deflection and Lengths of Spans, See Table XIX.

NOTE.—If the transverse values (r)—given for steel—are used, test each piece carefully, as steel varies greatly in strength. For *equal* deflections of steel and iron, add only 7½% to iron transverse values, instead of 25% as given in tables.

TABLE XXI.—LIST OF EVEN-LEGGED ANGLES.

Size of Angle	Weight per Yard.	Thickness	Area of Each Leg	Total Area.	Axis Parallel to one side. M—N: Moment of Inertia. (I)	Moment of Resistance (r)	Square of Radius of Gyration. (ρ^2)	Distance of Neutral Axis from Base.	Transverse Value (v) in lbs. For Iron.	For Steel.	Axis at 45° to sides. M—N: Moment of Inertia. (I)	Moment of Resistance. (r)	Square of Radius of Gyration (ρ^2)
6"	973	7/8"	486	973	31.91	763	3.28	1.829	61,000	76300	18.10	1.34	2.58
6"	575	1/2"	287	575	1991	461	3.46	1.685	36900	46100	7.75	1.35	2.39
4 1/2"	619	3/4"	309	619	1.120	360	1.80	1.396	28800	36000	4.88	0.772	1.98
4 1/2"	375	7/16"	187	375	720	224	1.92	1.286	18000	22400	2.65	0.707	1.82
4"	344	3/4"	272	544	766	281	1.40	1.271	22500	28100	3.45	0.634	1.80
4"	206	5/8"	143	286	436	152	1.52	1.138	12200	15200	1.86	0.630	1.60
3 1/2"	434	1/16"	2.17	434	468	197	1.08	1122	15750	19700	2.04	0.470	1.59
3 1/2"	248	3/8"	124	248	286	115	1.15	1.013	9200	11500	1.20	0484	1.43
3"	365	1/16"	182	365	277	1.38	0.76	0996	11000	13000	1.05	0288	1.41
3"	144	1/4"	072	144	124	058	086	0842	4640	5800	0.52	0.361	1.19
2 3/4"	277	9/16"	138	2.77	183	098	066	0887	7840	9800	061	0.220	1.25
2 3/4"	162	5/16"	081	162	1.15	059	071	0802	4720	5900	050	0309	1.13
2 1/2"	225	1/2"	1.12	225	1.28	076	057	0806	6080	7600	0.51	0227	1.14
2 1/2"	119	1/4"	059	1.19	070	039	059	0717	3120	3900	0.30	0252	101
2 1/4"	178	7/16"	089	1.78	078	051	044	0720	4080	5100	035	0.197	102
2 1/4"	106	1/4"	053	106	050	031	047	0654	2480	3100	022	0208	0925
2"	136	5/8"	068	136	045	033	033	0.634	2640	3300	0.21	0.154	0897
2"	94	7/32"	047	094	031	022	033	0580	1760	2200	0.13	0.138	0820
1 3/4"	996	5/16"	050	100	027	023	027	0559	1840	2300	0.12	0.120	0778
1 3/4"	621	5/16"	031	062	018	015	029	0507	1200	1500	008	0.129	0717
1 1/2"	840	5/16"	042	084	0.16	0.16	0.19	0487	1280	1600	007	0083	0689
1 1/2"	527	5/16"	026	053	011	010	021	0444	800	1000	005	0094	0628
1 1/4"	563	1/4"	028	056	0077	0091	0138	0404	728	910	004	0071	0571
1 1/4"	297	1/8"	015	030	0044	0050	0147	0358	400	500	002	0067	0506
1"	438	1/4"	022	044	0037	0056	0064	0340	448	560	002	0045	0481
1"	234	1/8"	0115	023	0022	0031	0096	0296	250	310	001	0043	0410
7/8"	293	3/16"	0145	029	0019	0032	0066	0286	236	320	——	——	0404
7/8"	203	1/8"	0100	020	0014	0023	0070	0264	184	230	——	——	0373
3/4"	246	3/16"	0125	025	0012	0024	0048	0254	192	240	——	——	0359
3/4"	172	1/8"	0085	017	0009	0017	0053	0233	136	170	——	——	0329

For Use of Transverse Values, also Deflection and Lengths of Spans, See Table XIX.

NOTE.—If the transverse values (r)—given for steel—are used, test each piece carefully, as steel varies greatly in strength. For *equal* deflections of steel and iron, add only 7½% to iron transverse values, instead of 25% as given in tables.

TABLE XXII. — LIST OF EVEN-LEGGED ANGLES.

Size of Angle	Weight per Yard.	Thickness.	Area of Long Leg	Area of Short Leg	Total Area. (a)	Axis Parallel to Short Leg: Moment of Inertia (i)	Moment of Resistance. (r)	Square of Radius of Gyration (g²)	Distance of Neutral Axis from Base.	Transverse Value (v) in lbs.: For Iron.	For Steel.	Axis Parallel to Long Leg: Moment of Inertia (i)	Moment of Resistance. (r)	Square of Radius of Gyration (g²)	Distance of Neutral Axis from Base.	Transverse Value (v) in lbs.: For Iron.	For Steel.	Axis M-N Parallel to A-B: Moment of Inertia (i)	Square of Radius of Gyration (g²)	Perpendicular Distance to Point of Neutral Axis from Apex.
6" x 4"	69.4	3/4"	4.22	2.72	6.94	24.52	6.26	3.53	2.050	50080	62600	8.68	2.97	1.25	1.078	23760	29700	5.72	0.825	2.00
6" x 4"	41.8	7/16"	2.53	1.65	4.18	15.46	3.83	3.70	1.964	30640	38300	5.60	1.84	1.34	0.964	14720	18400	3.55	0.849	1.86
5" x 3½"	58.1	3/4"	3.47	2.34	5.81	13.90	4.26	2.39	1.744	34080	42600	5.40	2.12	0.93	0.995	16960	21200	3.72	0.640	1.83
5" x 3½"	30.5	3/8"	1.80	1.25	3.05	7.78	2.30	2.55	1.610	18400	23000	3.19	1.21	1.05	0.860	9680	12100	1.96	0.642	1.63
4½" x 3"	50.6	3/4"	3.09	1.97	5.06	9.73	3.39	1.92	1.625	27120	33900	3.41	1.62	0.67	0.894	12960	16200	2.45	0.484	1.65
4½" x 3"	26.7	3/8"	1.62	1.05	2.67	5.49	1.83	2.05	1.490	14640	18300	1.98	0.88	0.74	0.740	7040	8800	1.25	0.470	1.47
4" x 3"	43.4	1 1/16"	2.51	1.83	4.34	6.52	2.50	1.50	1.390	20000	25000	3.08	1.46	0.71	0.890	11680	14600	1.86	0.428	1.56
4" x 3"	20.9	5/16"	1.20	0.89	2.09	3.37	1.23	1.61	1.260	9840	12300	1.64	0.732	0.785	0.760	5856	7320	0.77	0.368	1.40
3½" x 3"	40.0	1 1/16"	2.17	1.83	4.00	4.42	1.91	1.105	1.188	15280	19100	2.96	1.436	0.740	0.939	11488	14360	1.64	0.410	1.50
3½" x 3"	15.6	1/4"	0.84	0.72	1.56	1.91	0.744	1.224	1.035	6192	7740	1.30	0.587	0.833	0.785	4696	5870	0.61	0.391	1.28
3½" x 1½"	11.9	1/4"	0.84	0.35	1.19	1.50	0.688	1.260	1.320	5504	6880	0.17	0.144	0.143	0.320	1152	1440	0.16	0.134	0.76
3" x 2½"	27.7	9/16"	1.52	1.25	2.77	2.34	1.184	0.844	1.024	9472	11840	1.45	0.840	0.523	0.774	6720	8400	0.91	0.328	1.25
3" x 2½"	13.1	1/4"	0.72	0.59	1.31	1.17	0.560	0.893	0.910	4480	5600	0.74	0.402	0.565	0.660	3216	4020	0.36	0.275	1.10
3" x 2"	22.5	1/2"	1.38	0.87	2.25	1.93	1.007	0.858	1.083	8056	10070	0.62	0.437	0.275	0.583	3496	4370	0.47	0.209	1.13
3" x 2"	10.4	7/32"	0.63	0.41	1.04	0.97	0.480	0.934	0.980	3840	4800	0.35	0.230	0.336	0.480	1840	2300	0.24	0.231	0.93

For Use of Transverse Values, also Deflection and Lengths of Spans, See Table XIX

NOTE. — If the transverse values (*v*) — given for steel — are used, test each piece carefully, as steel varies greatly in strength. For *equal* deflections of steel and iron, add only 7½% to iron transverse values, instead of 25 as given in tables.

TABLE XXIII. — LIST OF TRENTON TEES AND DECK BEAMS.

Depth over all. (d)	Weight per Yard.	Width of Table or Flange. (b)	Thickness.	Area of Flange.	Area of Web.	Total Area. (a)	Axis Normal to Web: Moment of Inertia. (i)	Moment of Resistance. (r)	Square of Radius of Gyration. (g²)	Distance of Neutral Axis from Base.	Transverse Value (v) in lbs.: For Iron.	For Steel.	Axis Parallel to Web: Moment of Inertia. (i)	Moment of Resistance. (r)	Square of Radius of Gyration. (g²)	Transverse Value (v) in lbs.: For Iron.	For Steel.
4" TEE	37.5	4"	1/2"	2.00	1.75	3.75	5.56	1.97	1.48	1.18	15760	19700	2.62	1.31	0.76	10480	13100
3½" "	32.5	3½"	1/2"	1.75	1.50	3.25	3.64	1.49	1.12	1.06	11920	14900	1.82	1.04	0.56	8320	10400
3½" "	28.7	3½"	7/16"	1.53	1.34	2.87	3.26	1.32	1.14	1.03	10560	13200	1.53	0.87	0.53	6960	8700
3" "	27.5	3"	1/2"	1.50	1.25	2.75	2.21	1.07	0.80	0.93	8560	10700	1.15	0.77	0.42	6160	7700
3" "	21.1	3"	3/8"	1.13	0.98	2.11	1.76	0.834	0.834	0.89	6670	8340	0.97	0.65	0.46	5200	6500
2½" "	17.3	2½"	3/8"	0.93	0.80	1.73	0.98	0.563	0.566	0.76	4500	5630	0.49	0.39	0.28	3120	3900
2½" "	14.7	2½"	5/16"	0.78	0.69	1.47	0.85	0.483	0.578	0.74	3860	4830	0.40	0.32	0.272	2560	3200
2¼" "	11.9	2¼"	9/32"	0.63	0.56	1.19	0.56	0.352	0.470	0.66	2820	3520	0.26	0.231	0.218	1850	2310
2" "	11.5	2"	5/16"	0.625	0.525	1.15	0.41	0.302	0.352	0.61	2420	3020	0.21	0.210	0.182	1680	2100
2" "	9.4	2"	1/4"	0.50	0.44	0.94	0.35	0.247	0.372	0.59	1980	2470	0.16	0.160	0.170	1280	1600
1½" "	6.88	1½"	1/4"	0.38	0.31	0.69	0.13	0.125	0.188	0.46	1000	1250	0.07	0.093	0.101	745	930
1¼" "	5.46	1¼"	1/4"	0.31	0.25	0.56	0.076	0.089	0.136	0.40	710	890	0.042	0.067	0.075	535	670
1¼" "	4.86	1¼"	7/32"	0.27	0.22	0.49	0.065	0.075	0.133	0.38	600	750	0.034	0.054	0.070	430	540
1" "	3.3	1"	5/16"	0.18	0.15	0.33	0.030	0.044	0.091	0.315	350	440	0.016	0.032	0.048	255	320
1" "	2.76	1"	5/32"	0.15	0.13	0.28	0.024	0.034	0.085	0.295	270	340	0.012	0.024	0.043	190	240
2½" "	35.0	5"	1/2"	2.50	1.00	3.50	1.50	0.800	0.429	0.61	6400	8000	5.23	2.090	1.494	16720	20900
2½" "	17.3	3"	3/8"	1.12	0.61	1.73	0.54	0.370	0.312	0.54	2960	3700	0.85	0.567	0.491	4540	5670
2" "	14.6	3"	5/16"	0.94	0.52	1.46	0.47	0.324	0.322	0.52	2590	3240	0.68	0.453	0.466	3630	4530
1⅞" "	7.4	2¼"	1/4"	0.56	0.22	0.78	0.06	0.072	0.077	0.29	580	720	0.18	0.160	0.231	1280	1600
1½" "	9.0	2"	9/32"	0.56	0.34	0.90	0.17	0.170	0.190	0.50	1360	1700	0.18	0.180	0.200	1440	1800
1" "	6.5	2"	1/4	0.50	0.19	0.69	0.04	0.054	0.058	0.26	430	540	0.14	0.140	0.203	1120	1400
1" "	5.6	1½"	1/4	0.37	0.19	0.56	0.04	0.055	0.071	0.28	440	550	0.07	0.093	0.125	745	930
8" DECK BEAM	65.0	4½"	5/8	FLANGE 1.40 BULB 1.25		2.65	6.50	54.70	11.28	8.42	3.15	90240	112800	3.7	1.64	0.570	13120	16400
7" " "	55.0	4½"	5/16	FLANGE 1.35 BULB 1.20		1.75	5.50	35.10	8.05	6.38	2.64	64400	80500	3.6	1.60	0.650	12800	16000

For Use of Transverse Values, also Deflection and Lengths of Spans, See Table XIX

NOTE. — If the transverse values (*v*) — given for steel — are used, test each piece carefully, as steel varies greatly in strength. For *equal* deflections of steel and iron, add only 7½% to iron transverse values, instead of 25% as given in tables.

$$r_1 = \frac{46,8}{1,3966} = 33,6$$ or the beam would not be strong enough. The next size would be the $12\frac{1}{4}'' - 125$ pounds per yard beam, but as the $15'' - 125$ pounds per yard beam would cost no more and be much stronger we will try that. Its width of flange is $b = 5''$ and moment of resistance $r = 57,93$. Inserting these values in (Formula 78) and using r in place of w we have

$$r_1 = \frac{57,93}{1 + \frac{0,0192.25^2}{5^2}} = \frac{57,93}{1,48}$$

$$= 39,14$$

The required moment of resistance was

$r = 44,2$ so that this is still short of the mark, and we should have to use the next section or the $15'' - 150$ pounds per yard beam. The moment of resistance of this beam is $r = 69,8$ its width of flange the same as before, therefore:

$$r_1 = \frac{69,8}{1,48} = 47,1$$

Or this beam would be a trifle too strong even if unsupported sideways. We need not bother with deflection, for the length of beam is only $1\frac{2}{3}$ times the span, and besides not even $\frac{2}{3}$ of the actual transverse strength of the beam is required to resist the vertical strains, and, of course, the deflection would be diminished accordingly.

Safe Uniform Load. The column in Table XIX headed "Transverse Value," gives the safe uniform load, in pounds, if divided by the span in feet, for beams supported sideways. Of course the result should correspond with Table XV, except that the uniform load will be expressed in pounds here, while it is expressed in tons of 2000 pounds each in the table. For Tables XX, XXI, XXII and XXIII the use of the "Transverse Value" is similar to Table XIX.

LOUIS DECOPPET BERG.

[To be continued.]

UNVEILING A PLASTER MODEL IN PLACE OF THE REAL STATUE.—Not long ago a Chicago sculptor, who had arranged to make a bronze statue of heroic size for a society in a neighboring State, discovered that it would be impossible to get the enormous figure cast by the day set for its unveiling. He consulted with the committee having the exercises in charge and was assured that the unveiling could not be postponed under any circumstances. The sculptor, as a last resort, put a coat of bronze paint on a clay model of the statue, shipped the brittle sham to the city in which the ceremony was to take place, and set it up on the pedestal. There it was successfully unveiled before an audience of thousands. Orators grew eloquent in praising its majestic appearance, and no one except the sculptor and the committee knew that it was not made of enduring bronze. A few days later the sham statue gave place to the real one. — *Chicago America.*

HAIR ROPES USED IN BUILDING. — A ton of ropes made from the hair of the women of Japan is used in building the $3,000,000 Buddhist temple at Kioto.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF J. C. ABBOTT, ESQ., MONTREAL, CANADA.
[Gelatine print, issued only with the Imperial Edition.]

SKETCH FOR AN ARTIST'S COUNTRY HOUSE BY MR. J. G. HOWARD.

HOUSE FOR HENRY ENDICOTT, ESQ., CAMBRIDGE, MASS. MESSRS. CHAMBERLIN & WHIDDEN, ARCHITECTS, BOSTON, MASS.

DESIGN FOR CONGREGATIONAL CHURCH, ELIZABETHTOWN, N. Y. MR. E. W. GIBSON, ARCHITECT, NEW YORK, N. Y.

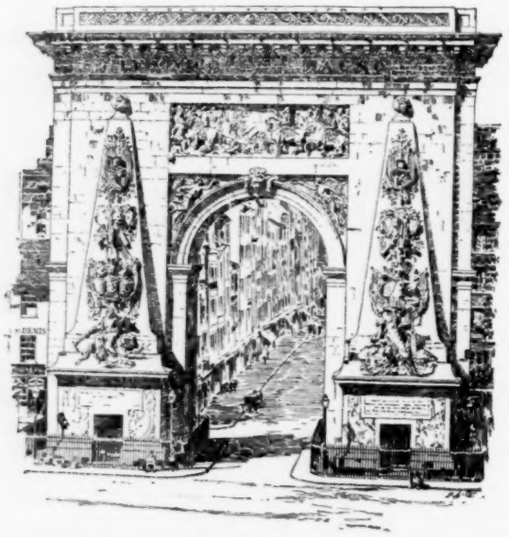
CHURCH AT DUBLIN, N. H. MESSRS. ANDREWS & JAQUES, ARCHITECTS, BOSTON, MASS.

BUILDING FOR THE PIONEER PRESS, ST. PAUL, MINN. MR. S. S. BEMAN, ARCHITECT, CHICAGO, ILL.

PLANS FOR APARTMENT-HOUSES. MR. E. T. POTTER, ARCHITECT, NEW YORK, N. Y.

STUDY FOR A STORE BUILDING, ST. PAUL, MINN. MESSRS. GILBERT & TAYLOR, ARCHITECTS, ST. PAUL, MINN.

UNITED STATES GOVERNMENT BUILDING PRACTICE.[1]—X.



Porte St. Denis, Paris.

STRAINS are calculated by the graphic method, first, because the graphic method checks itself, and second, so that the strains for all trusses may be put on file and at any future time they may be referred to and the assumed loads and consequent strains may be readily seen.

SPECIFICATION FOR IRONWORK.

The contractor to furnish all materials and labor and put in place complete all the ironwork shown on the drawings and required by the specification of the shapes, dimensions, weights, thickness of metal, and set in positions plumb and level or at the proper inclinations, as the case may be.

Quality of Wrought-Iron. — All the wrought-iron beams, channels, angle-irons, tie-rods, etc., must be tough, ductile, fibrous and uniform in character, of American manufacture or equal thereto, of best quality iron, and must be rolled or wrought straight and true, and to have an elastic limit of at least 26,000 pounds and an ultimate tensile strength of at least 50,000 pounds per square inch of sectional area, and elongation not over 18 per cent in 8″. If foreign iron is offered it must be accompanied by proper certificates of tests.

All specimens cut from shape iron to stand a test of bending cold through 180° on a diameter not greater than twice the thickness of bar without showing signs of fracture.

All steel to be mild steel, having an ultimate tensile strength of 70,000 per square inch and an elastic limit not less than 36,000 pounds, and an elongation of 22 per cent in length of 8″.

Floor-Beams and Girders. — The beams, girders, channels, etc., to be framed as shown and to have standard connections, angle-irons, rivets, bolts, etc., except where otherwise shown. Beams forming girders to be bolted together through cast-iron separators not over 6′ apart (two bolts to each separator), and beams resting on top of girders to be bolted through flanges. The ends of beams and channels to rest 8″ in walls on bed-plates; if iron, 8″ x 12″ x 1″, and if stone, 8″ x 12″ x 2 1-2″, and girders to have bed-plates under them in walls of sizes shown.

Channels where required for skewbacks of arches to be anchored securely to walls by expansion-bolts 3-4″ diameter, 6″ to 8″ long, spaced generally 3′ apart. All girders and every alternate beam for floors above first story to be anchored to walls by wrought-iron anchors 3-4″ diameter, 3′ long, V-shaped, and let through web of beam 4″ from end.

Wrought-iron tie-rods 1″ diameter of proper length where shown on drawings to be provided for vault-arches and for all walls necessary to counteract the thrust of the arches; the tie-rods to pass through webs of at least two beams, and to have gib-plates 12″ x 4″ x 1-2″ built 1′ in walls and to be threaded and have nuts and washers on both ends.

The girders to be secured to lugs on heads of columns by bolts 3-4″ to 1″ diameter (two to each pair of beams), the beams of coupled girders [*i. e.*, one beam on top of another], to be riveted together through flanges on both sides of webs their entire length with 5-8″ diameter rivets spaced 4″ apart at ends for a distance of 3′ and 8″ apart at middle of spans. [Where beams are so riveted, their strength is increased fully one-third more than if left unriveted.]

The heads and nuts of all bolts and pins to be hexagonal. All bolts, rivets, etc., to be of the sizes shown, to be well fitted to and perfectly fill the openings designed to receive them.

Quality of Cast-Iron. — All the cast-iron must be best quality, sound and clean, free from cracks, bubbles, cinders and other defects; the moulded and ornamental work, bases and capitals of columns, etc., to be fine stove castings sharp and clean; all joints to be properly dressed to insure a perfect fit; the heads of screws and bolts to be countersunk flush with face of work.

Columns. — Cast-iron columns for supporting second-story girders on which rest the walls and floors to be in two pieces, the shaft in one piece, and the head with the flanges, lugs, etc., cast on to fit the profile of beams in another piece; a cast-iron stand is also frequently made on which the column rests. The stone cap of pier or template in wall to be dressed perfectly smooth and level on top, on which the iron bed-plate of column (usually 1 1-2″ to 2″ thick) rests, and to which it is secured by two expansion bolts 1″ diameter about 6″ long, the iron bed-plates to have a boss ring cast on about 1″ high, which is to fit accurately into core of columns or stands as the case may be; great care to be used in casting to have a uniform thickness of metal in the shafts, stands and heads respectively. The heads to have a boss from 2″ to 4″ long fitting into core of columns, the bearing-surfaces of plates, stands, shafts and heads to be turned perfectly smooth and at right angles to axes; the cores to be bored out to the depths required and the bosses turned to fit cores. The columns to be secured on top of stands by two 1″-diameter bolts. The stands, shafts and heads of columns to be of the same thickness of metal and uniform.

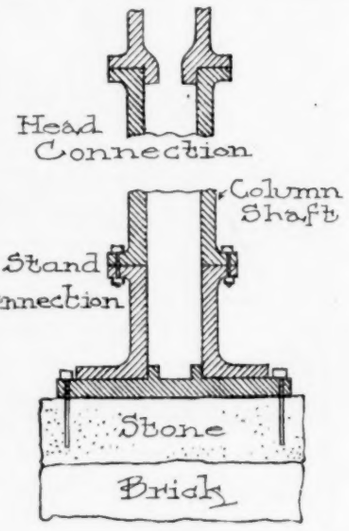


Fig. 39.

Bases, Capitals, etc. — The moulded bases and ornamental capitals of columns to be cast-iron 1-4″ or 3-8″ thick metal, in accordance with full-size detail or model, which will be furnished the contractor; the plinth of bases to go 1″ below floor line; all to be fastened together with 5-16″-diameter countersunk screws and to shafts with 1-2″-diameter countersunk top screws after the fireproof covering is put in place.

Pilasters. — The ornamental pilasters to be 3-8″ thick cast-iron, to be square, corresponding in design and detail to the columns, and secured to walls by expansion bolts 1-2″ diameter, 6″ long, passing through lugs on the pilasters (about eight to each pilaster).

Wrought-Iron Posts. — Instead of cast-iron columns, wrought-iron posts are frequently used, constructed of an I-beam in centre and channel-irons riveted to same through flanges, with angle-irons riveted to bottom and top to form bearing surfaces.

Fig. 40.

Lintels. — Cast-iron flanged lintels are frequently used for openings in brickwork; they are to have a bearing of not less than 4″ on jambs, to be 1-2″ thick metal, and to have a vertical rib their entire length from 4″ to 6″ high. Frequently a wrought angle-iron 3″ x 3″ or 4″ x 4″ is used for this purpose and is concealed between the brickwork and the wood frame for opening.

Roof. — The iron roof to be framed with trusses, hips, ridges, rafters, shoes, bearings, etc., as shown, the details of which must be strictly adhered to. The trusses to be constructed of wrought-iron rafters, tie-bars, struts, braces, etc., and secured by bolts to cast-iron shoes or angle-irons, which are to be secured to bearing-plates by expansion bolts. The braces for trusses and between different trusses to have sleeve nuts for adjustment.

[1] Continued from page 166, No. 641.

Eye-bars.—The bars for swivel connection to be of square or round iron as shown, the full size to be carried round the loops which shall be well and truly formed and welded.

The swivel ends of bars to be up-set and forged round and to have right and left hand thread cut so that the sectional area at the root of the threads shall equal the area of the bars. All eye-bars must be free from flaws, of full and uniform thickness, and perfectly straight before being bored. The pin holes must be in the centre of the head and on the centre line of the bar. The bars must be bored to exact lengths and the pin-holes not more than 1-64″ larger than the finished diameter of pins. Each bidder must state his mode of manufacture of eye-bars.

Pins.—All pins to be turned straight and smooth and to fit the pin-holes to within 1-64″; the diameters of the pins, as noted in the drawings, are the nominal diameters; the finished or turned diameters to be 1-16″ less; the ends of all pins to be turned down to take the nuts to a diameter 1-2″ less than diameter of pin; the nuts, unless otherwise shown, to be 3-4″ thick hexagonal, and have a short diameter 1″ greater than diameter of pin; the threads to be eight per inch; the spools for pins to be wrought-iron pipe, the inner diameter of which to be 1-4″ greater than diameter of pin.

Jack Rafters.—All jack rafters between trusses to be framed into beam purlins, which must be substantially secured to trusses; all rafters and hips to have wrought-iron angles riveted to webs for footing up and anchoring to bearing-plates, which must be secured to walls by expansion-bolts. All framing for beam purlins, jack and hip rafters, deck beams, etc., to be made by angle-irons properly shaped for fitting; fish-plates, etc., secured in place by rivets and bolts of standard sizes, as specified for floor framing. All joints and mitres of beams, channels, bars, angles, etc., must be cut clean and accurate to the proper and true angle and fitted closely. [It is usual to rivet all work which can be done at the shops; the remainder is generally put together with bolts.]

Rivets.—All rivets used throughout the work, not otherwise noted, shown or specified, to be 5-8″ and 3-4″ diameter as required.

All rivet-holes must be accurately punched or drilled so that the pieces to be connected shall permit of being riveted without the use of drifts.

All rivets to have "cup heads," except where countersinking is necessary and all rivets must completely fill the holes.

Shape Iron.—The contractor will not be limited to shape iron furnished by any particular mill and variations from the shapes shown by the drawings will be allowed provided the sectional area is not diminished; such changes, however, must receive the approval of the Supervising Architect before being carried into effect and no additional compensation shall be claimed or allowed therefor.

Tension Members.—The tension members of trusses, etc., must be of the best quality, double-refined iron and finished bars must be thoroughly welded in the rolling and free from injurious seams, buckles, blisters, cinder-spots and imperfect edges.

Specimens for Tests.—The successful bidder will be required to provide for testing, without extra charge, specimens of the iron, about six in all, which he proposes to use, shaped according to a diagram which will be furnished, and no iron shall be worked into members of the roof, etc., until after specimens shall have been tested and the quality of the iron approved by the Supervising Architect. The specimens or test-pieces will be about 10″ long, with area reduced to one-half square inch for a length of 10″ and the elongation, as noted below, shall be measured for a length of 8″.

The following table shows the ultimate strength and elongations which the different kinds of iron will be required to show when tested in specimens of the sectional area and length as above specified.

Specimens of	Ultimate Tensile Strength	Elongation in a Length of 8 in.
Flats, rounds and squares	50,000 lbs.	18 to 20 per cent.
Angles and other shaped iron	50,000 "	12 " "
Plate iron	45,000 "	10 " "

All rivets and pins must be of the best quality, doubled-refined iron.

All tension members made by welding the eye to the bar shall be tested to a stress of 20,000 pounds per square inch before being accepted by the Government.

The contractor will be required to furnish facilities for the inspection of the iron and workmanship to the duly accredited agent of the Government.

If it be deemed necessary to cut specimens for testing from finished pieces of the structure, such finished piece will be paid for at cost; but should the iron so tested not withstand the required tests, it will be considered as rejected, and no compensation therefore will be allowed.

Purlins.—The entire iron framing of roofs, steep portions, decks, roof and sides of dormers, etc., to have rolled-iron 2″ x 2″ x 1-4″ L-bar purlins spaced generally 16″ apart secured at each bearing with 3-8″ diameter rivets, where purlins abut masonry, 2″ x 2″ L irons for supporting the ends of them to be bolted with 3-4″ x 6″ expansion bolts 4′ apart.

WROUGHT AND CAST IRON ROOF TRIMMINGS.

Gutters.—Gutters with the crown mould of cornice are frequently made of cast-iron 3-8″ thick, the bottoms to be graded to drain water to outlets and to extend up under the eaves of slate or roof covering and secured to ironwork of roof by bolts, and the crown mould secured to stone or brickwork by expansion bolts 5-8″ diameter every 3′ apart, outlet hoppers to be cast with the section of gutter at points noted to connect with 4″ diameter down piping, they should be cast in form 6′ to 8′ lengths and all joints lapped 2″ made flush and the sections fastened together with countersink screws or bolts.

Hips, Ridges, etc.—Deck cornices, hips, and ridges are frequently made of cast-iron 3-8″ thick with the necessary stiffening ribs spaced about 3′ inch apart, to be made to fit closely to slate or roof covering, all cross joints to lap 2″ made flush and the work fastened together and to brackets by 1-2″ diameter countersink bolts or screws, the brackets to be cast-iron with 3″ wide spaced about 3′ apart and bolted to the iron framing of roof.

Scuttles are usually made of frame of boiler plate iron 1-8″ thick or cast-iron 3-8″ thick with angle-irons riveted or bolted in corners and to bottom edges and the angle-irons bolted to roof beams with 3-8″ diameter bolts, the cover to be of galvanized sheet wire No. 16 B. W. G. riveted to 1 1-2″ x 1 1-2″ angle-iron frame and to be hung and provided with heavy wrought-iron hinges, hasps and staples securely riveted or bolted.

Ventilators.—Generally Emerson's ventilators or Hayes's ventilating skylights are used, the frame-work is constructed of angle-irons or where very large, of small rolled-iron beams securely riveted or bolted at all connections with from 3-8″ to 5-8″ diameter bolts, the base louvres and roof to be No. 16 (or 20) B. W. G., galvanized sheet-iron lapped 1 1-2′ and riveted at all connections and riveted to framing, and rafters. The roof and part of the sides of Hayes's ventilating skylight to be provided with heavy ribbed glass from 1-4″ to 3-8″ thick.

Skylights.—The small skylights are generally made of Hayes's standards as shown in his illustrated catalogue, the supports for same to be 3″ x 4″ angle-irons framed with angles and rivets and bolted to iron roof framing or to brick walls by expansion-bolts, the skylights generally have a curb about 6″ high above roof.

Cresting and Finials, are generally made of wrought-iron, but frequently cast-iron; the different sections should be thoroughly secured together by rivets, wedges and bolts and also secured to the ridge beam or purlins and securely braced using wrought knees, angle-irons, rods, etc., as may be necessary. All joints in exposed cast-iron work to be made water-tight by using red lead, elastic cement or other approved substance. All holes in cast-iron work for bolts or screws must be drilled.

STAIRS.

The stringers and trimmers to be wrought-iron beams and channels as shown, all securely framed together and to bearing plates with standard angle-irons and bolts. Bent carriage-beams to be used where shown. The wall stringers to be channel-irons bolted to brickwork with 3-4″ x 6″ expansion-bolts 3′ apart. The wall bearings for beams and channel-irons to be at least 8″, resting on plates 8″ x 12″. Bracket step carriages to be cast-iron 3-8″ metal 3″ wide flanges of various shapes and dimensions required. Brackets for casings to be about 2′ apart. Each bracket to be bolted to stringers, with 2 1-2″ bolts. The risers, casings, newels-posts, balusters, etc., to be of cast-iron of the thickness and design shown all securely fastened to supports. All ornamental cast-iron work to be fine stove castings of designs shown on detail drawings. All mitres in cast-iron work to be properly faced to insure a perfect joint. The holes for bolts and screws to be drilled. No wood blocks or wedges to be used.

The rolled-iron required for framing to be of American manufacture and subject to same tests as specified for other structural ironwork. Iron balusters to be firmly secured, as shown, to support and to core-rail above. The core-rail to be 1 1-4″ x 1-4″ drilled and countersunk every 12″ apart for screws to secure handrail. Handrail to be of mahogany, walnut or oak closely bolted at joints and finely polished. The treads and platforms to be of dark blue or purple slate 1 1-2″ thick rubbed on all exposed sides and edges, of shape, and secured, as shown on drawings: the treads to be in one piece each: the platform to be jointed if necessary over the trimmers as shown on drawings. The soffits of stairs and platforms to be furred with angle-irons to the lines required and lathed with approved iron laths ready for plaster, or where panelled soffits are shown the mouldings to be executed in cast-iron 1-2″ thick and the flat panel in galvanized sheet-iron all securely bolted in places.

Where treads and platforms are made of cast-iron they are to be diamond-channelled or checkered on top, the channelling to be raised 1-8″ and to have a smooth margin of 1″ all around.

The wall skirting of stairways to be cast-iron to follow the line of treads and platforms and to start and stop on landings against the architraves of the nearest door, to be made in strict accordance with details and have stiffening ribs every 2′ and fastened to walls with 3-8″ diameter x 8″ long countersunk expansion-bolts 3′ apart and to ironwork where necessary with top bolts or screws.

Spiral stairs to have treads, risers and section of newel cast in one piece and built around a wrought-iron pipe and each step secured to same by top screws; the balusters to be thoroughly screwed to treads and to railing.

Step-ladder from attic floor to scuttle in roof to be constructed of two 6″ channels for stringers secured at bottom with 3″ x 3″ angle-irons and two 9″ long x 3-4′ diameter expansion-bolts. The treads to be white oak 1 1-4″ thick resting on angle-irons 3″ x 3″, riveted to stringers, by two 5-8″ diameter rivets, and the steps secured to angle-irons by three wood-screws to each angle.

Wrought-iron gratings to be provided for small window areas, the frame to be 2″ x 3-8″, let into stone coping and have 3″ bearing, the bars to be 1 1-2″ x 1-4″, swaged into frame and held apart in centre by iron spools with rod passing through.

FENCES.

Iron fences are generally placed on the street fronts of Government buildings; on the rear and side either wooden board fences or brick walls are built.

Iron fences are usually built on top of stone copings or on stone blocks set about 18″ in the ground for each post to rest on. The posts, rails, pickets and ornamental work between pickets are made of wrought-iron; the posts are generally spaced 6′ to 8″ apart and are made 1 3-4″ square, with small posts 1″ square, about 1′ to 2′ apart; the main posts and each alternate small post to have cast-iron collar on boss fitting coping and are leaded into stone coping 4″, the small posts, which are not leaded, to stop at top of stone, the bosses to be fastened to post by 3-8″ diameter countersunk tap-screws; the small posts pass through the rails and are swaged thereto. The rails (generally three) to be 5-8″ x 1 3-4″, the ends bent at right angles and fastened with two 3-8″ diameter bolts to large posts; all ironwork, where necessary, to be let into stone coping, posts or wall of building at least

4″, leaded and caulked tight; the scrolls and ornamental work to be secured to rails and posts with 3-8″ diameter rivets (or screws where rivets cannot be used) and to stonework with 3-8″ x 4″ bolts.

Sometimes cast-iron posts are used. They are generally made 4″ square, 1-4″ thick, placed 8′ to 10′ apart, and are set in the ground about 18″, having a cedar post driven firmly in the hollow base of post and set in the ground from 3′ to 4′; the rails to which the intermediate posts, pickets and ornamental work are secured are fastened to the cast-iron posts by tap-screws or bolts. The gates for entrances to driveways and interior walks are made of wrought-iron with scrolls, ornamental panels, braces, etc., and riveted with round-head rivets. The stanchions to which the gates are hung to be wrought-iron let into stonework 6″ and the brace fastened with 1-2″ diameter x 4″ long expansion-bolts with hexagonal heads; the double gates have a bolt on standing leaf which is to be dropped into hole in stone gate-stop; the other leaf of double gates and the small gates are to have approved stops, hasp, staple and latches for fastening; the double gates to have spring catches secured to stone blocks to hold them when open.

Ornamental iron grilles are usually made of wrought-iron (sometimes cast) and have a frame of 1 1-4″ x 1-4″ secured to masonry by 1-2″ diameter x 3″ long expansion-bolts.

For steps and platforms at mail entrance and on coping of basement-entrance area, is provided a railing, the posts about 4′ apart and from two to three rails, all of wrought-iron 2″ diameter gas-pipe, with cast-iron beaded fittings secured to rails by tap-screws; frequently the pipes are screwed into fittings as far as practicable; the post to have a cast-iron boss secured to stone by 3-8″ diameter x 6″ long expansion-bolts and the posts fastened to boss by three 3-8″ diameter tap-screws.

Iron partitions are made of studs spaced 16″ on centres, sills, and cap, all of 4″ light channels or I-beams framed and secured together by angle-irons, rivets and bolts; the end pieces, sill and cap are secured every 6′ to masonry by expansion-bolts.

Lattice partitions for vaults are made of steel; three and five ply welded steel and iron and iron bars 1″ x 1-4″ or 3-8″ spaced 4″ on centres and inclined at an angle of 45°, the sides, bottom and top to be riveted in between angle-irons 1 1-2″ x 1 1-2″, and the angle-irons secured to steel lining of vault by tap-bolts 8″ apart or to masonry by expansion-bolts 8″ apart on alternate sides of partition.

Illuminating tiling is used in sidewalks to give light to vaults and frequently in the first floor to give light to the interior of basement.

The curbs or frames are made of cast-iron, with ribs and flanges and fastened to beams, etc., properly framed for same with bolts or screws, the top being flush with floor or sidewalk. The tiles are made 1 1-4″ thick and the glass lenses 3″ to 4″ across, either circular or hexagonal, smooth on top; the spaces between lenses are filled in with Portland cement or other approved substance. Sometimes small lenses about 2″ diameter are set into iron frames and leaded.

Painting.— All iron work to be cleaned of scales and dirt and to receive one coat of metallic or red-lead paint in oil before leaving the shop.

All pins, pin-holes and machined surfaces must be coated with white lead and tallow before being shipped, in riveted work all surfaces coming in contact to be painted before being riveted; bearing and other surfaces not accessible for painting after erection to receive two coats of paint before leaving the shop.

After erection and completion, all the ironwork to be thoroughly and evenly painted, one coat of metallic or red-lead paint mixed with pure linseed oil.

Vault Doors. — Vaults in Government buildings a few years back were generally lined with steel, single steel lining 1 1-4″ thick, or double steel lining 2″ thick; this is seldom done now, but fire and burglar proof vault doors are provided for the vaults which are generally located in the interior of the building, and enclosed in solid brick walls, the doors are generally 3′ x 7′ and 3″ thick, built of alternate layers 1-4″ thick of welded steel and iron, secured together with rivets, screws, twisted iron and conical shaped bolts; the edges of doors and their repective jambs are constructed with steps, tongues and grooves perfectly fitting each other: the doors are provided with 2″ diameter bolts made of cold rolled shafting-iron (usually 8 bolts) and the hinges made of wrought-iron with steel-pins: the frames for the doors are constructed of wrought-iron or steel, the jambs are made the full depth of brick walls and secured by 3-4″ diameter expansion-bolts spaced 12″ apart.

The locks used are combination locks, generally the combination time-locks manufactured by Sargent & Greenleaf.

The inside door of vault is made of boiler-iron, arranged and hinged to open in the jambs with the necessary bolts and a tumbler-lock opened with a key; these are usually called day doors.

MEASUREMENT.

Most all ironwork is estimated by the pound: ornamental ironwork such as stairs, fences, grilles, crestings, finials, etc., of course is dependent mostly upon the design for the cost. Cast-iron is generally estimated at 450 pounds, and wrought-iron at 480 pounds per cubic foot, the unit is generally taken as a square foot 1″ thick weighing 37 1-2 pounds for cast-iron and 40 pounds for wrought-iron.

The actual volume should be taken deducting all holes, except those punched or cut out for bolts, rivets, etc.; for rolled-iron all the weights per lineal foot or yard are given by the rolling-mills' hand-books, and the weight is obtained by simply multiplying by the length of the piece.

Iron girders carrying only floors, weigh from 60 pounds to 100 pounds per lineal foot, and carrying ordinary walls and floors for a two or three story building from 130 pounds to 200 pounds per lineal foot, seldom as high as the latter, these of course are dependent upon the loads and spans.

Floor-beams for a small building will average 5 pounds to 6 pounds per square foot of floor area, and for a large building 6 pounds to 7 pounds per square foot.

Iron roofs without trusses but including purlins will weigh from 8 pounds to 10 pounds per square foot of roof area, and including the average number of trusses about 12 pounds. The iron roof for the Government building at Nashville, Tenn., which had a great many trusses averaged 14 pounds per square foot.

COST.

The cost of iron is so changeable and is dependent upon so many causes that scarcely any general approximate data can be given. In the past few years it has varied in price from 6c. to 2c. for cast-iron and from 8c. to 3c. for wrought-iron. In estimating cast-iron, the cost of making patterns and whether they can be used for one or more articles must be taken in account. Rolled-iron and plain cast-iron can be estimated at the rates given in the quoted weekly price lists. Ornamental ironwork can be estimated correctly after careful experience.

Cast-iron bed-plates, cost from	1 1-2c.	to 3c.	per pound.
Cast-iron columns, etc., cost from	3c.	to 5c.	" "
Rolled-iron beams, channels, etc., cost from	4c.	to 7c.	" "
Iron roof construction, cost from	6c.	to 10c.	" "

Iron stairs for public stories, including ornamental balustrade cost from $20.00 to $45.00 per step.

Grilles and window screens cost from $1.00 to $2.00 per square foot, up.

Iron fences with posts 7′ to 8′ apart, with wrought-iron pickets, rails, scrolls, etc., cost from $2.50 to $3.00 per lineal foot.

Pipe railing, cost from $1.00 to $1.50 per lineal foot.

Jas. E. Blackwell.

GENERAL Q. A. GILLMORE.

Of General Q. A. Gillmore, who died April 7th last, the New York *Times* says:

Historians and biographers have written of Gen. Gillmore that he was the greatest artillerist and one of the greatest engineers in the war of the rebellion. He was born at Black River, Lorain County, Ohio, Feb. 28th, 1825. His father, Quartius Gillmore, a farmer, moved to Ohio from Massachusetts in 1811, becoming one of the pioneers on the "Western Reserve." He was born on the day on which the news of John Quincy Adams's election to the Presidency was received at Black River, and his father expressed his gratification at the result by naming his first-born after the President. The boy's early years were all spent on his father's farm, his only "schooling" being obtained during three months in winter. When thirteen years old he was sent to the Norwalk Academy, twenty-five miles distant from his home. Here, in a few years, he was made a teacher, with some of his former classmates for pupils. Later he entered Elyria Academy, where, in 1845, he secured first place in English composition by writing his first and, as far as known, his only poem. This production attracted the attention of the Hon. E. S. Hamlin, Member of Congress for the district, and he offered young Gillmore a cadetship at West Point. The student accepted it. Before his first year with his class had closed he was its leader in mathematics, and in 1849 was graduated at its head. In the year of his graduation he married Miss Mary O'Maher of West Point.

His high standing in his class determined the nature of his assignment to duty, and he was made Brevet Second Lieutenant in the Corps of Engineers. He served as Assistant Engineer in building Forts Monroe and Calhoun, for the defense of Hampton Roads, Va., from 1849 to 1852. In the latter year he was ordered to return to

West Point to act as assistant instructor of practical military engineering. Sept. 5th, 1853, he was given his commission as Second Lieutenant of Engineers, and was Treasurer and Quartermaster of the Academy during 1855 and 1856. July 1st, 1856, he was commissioned a First Lieutenant in his corps, and was again sent to Fort Munroe, to act as assistant engineer in the construction of the works there. In a few weeks, however, he was given charge of the engineer agency in New York city, and he also had charge of the work of supplying and shipping materials for the fortifications. During 1857 and 1858, Lieut. Gillmore had charge of the fortifications in New York Harbor, and he remained in control of the Engineering Agency until the breaking out of the war in 1861. During his later years at the Military Academy, from 1852 to 1856, he made many experiments with round-shot projectiles against masonry. During his control of the New York Harbor fortifications and the Engineering Agency he experimented extensively with limes and cement, with especial reference to their use in the masonry of fortifications.

Lieut. Gillmore applied for active duty in the field in August, 1861, and he was at once called upon to fit out the expedition against the coast defenses of South Carolina. He was made Captain, and Chief Engineer to Gen. W. T. Sherman. In November and December, 1861, he succeeded in fortifying Hilton Head, and then the attention of the corps was directed towards Savannah. Fort Pulaski, situated on a marshy island, covered both channels of the Savannah River, and its demolition was necessary in order to render the approach of Union vessels to the city possible. The oldest and ablest engineers in the service declared that, owing to the peculiarly marshy or slimy condition of the land on the coast, upon which guns could not be placed, it would be absolutely impossible to subdue the fort — that, in fact, it was impregnable.

Late in November Capt. Gillmore was ordered to make a reconnoissance of the locality, and two days later reported that he deemed the reduction of Fort Pulaski practicable by means of batteries of mortars and rifled guns placed on Tybee Island. He would require, he said, 10 10-inch sea-coast mortars, 10 13-inch sea-coast mortars, 8 heavy rifled guns, and 8 columbiads. This proposition was received with astonishment by Capt. Gillmore's superior officers, and was treated with ridicule by some of the older engineers of the corps. Tybee Island was something over 1,700 yards from Fort Pulaski, and the limit for the practicable breaching of masonry forts was then generally supposed to be 1,000 yards; in fact, the limit was considered to be from 600 to 700 yards, excepting under peculiarly favorable circumstances. Even at these distances from four to seven days' firing, with considerable artillery, was considered necessary in order to render a breach practicable. Capt. Gillmore was unable to quote any authority for his belief that Fort Pulaski could be breached at a distance of 1,700 yards, and had only his theoretical ideas and his experiments to give him assurance. The position of the fort was such, that Gen. R. E. Lee, in the winter of 1861, notified the commander that he had nothing to fear from Tybee Island, as it was not within even dangerous distance. Capt. Gillmore, however, believed that the capacity of rifled guns had not been fully appreciated. Gen. Totten, the venerable head of the corps, frowned upon the young captain's scheme as visionary. The general commanding, however, while not fully convinced of the wisdom of the scheme, determined to let him try it, so he endorsed the plan and sent it to Washington. Six weeks later a reluctant consent was given, and operations were begun.

In order to cut off communication between the fort and Savannah, it was necessary to place batteries on the shore of the river above the fort. The coast was a marsh filled with mud and slime from two to twenty-five feet deep, yet the heavy guns of the battery were transported across it for four miles to Venus's Point, on Jones's Island. The transportation was accomplished by hand power over a wheelbarrow track of plank. This, of itself, was considered to be a most remarkable feat of engineering, but, the battery once established at Venus's Point, Fort Pulaski was isolated. The Confederate garrison did not obtain an inkling of these operations, which were carried on by night and by day. Tybee, like Jones's Island, was a marsh full of slimy mud, but there were solid ridges on the former at intervals, and to these the heavy guns were transported in the same manner as in the latter place. Although the island was in full sight of the fort, the operations of Capt. Gillmore's force were so carefully conducted that the garrison knew nothing of what was going on.

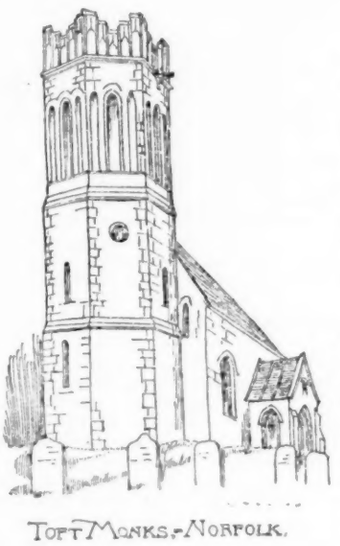
When the batteries were all in position extending in an arc for 2,550 yards, Gen. Sherman determined that Capt. Gillmore should have all the honor of success, or bear all the burden of failure, and he accordingly authorized him to act as Brigadier-General, in the meantime soliciting the appointment for him from the President. Thenceforward Gen. Gillmore had all the details in his own hands. He gave detailed instructions to the gunners as to range, elevation, and intervals of fire, and on the evening of April 9th, 1862, issued his order for the bombardment. On the morning of the 10th, the firing began. It was soon found that the smooth bores, mortars, and columbiads were useless at the distance for the purpose of making breaches, but the rifled guns soon began to have a telling effect upon the fort, while the responses from the garrison did not come anywhere near the Union batteries. Before night a breach was almost effected, and by two o'clock the next afternoon the fort, in a dilapidated condition, was surrendered to Gen. Gillmore. This achievement created a sensation throughout this country, and, in fact, all over Europe, for it rendered vulnerable half the fortifications of the world. Gen. Gillmore's provisional appointment as Brigadier-General was confirmed by the President, and soon afterward he came home to New York on sick leave, having been attacked by malaria. In October, he was assigned to command the district of Central Kentucky. Here he defeated Pegram at the battle of Somerset, and drove him across the Cumberland. For this he was brevetted Colonel of Engineers.

Later in the same year, Gen. Gillmore accomplished some brilliant artillery exploits in the bombardment of Charleston, for which he was highly commended in the annual reports of the General-in-Chief. Soon afterward he was made a Major-General of Volunteers. He acted for a time as Inspector-General of the fortifications of the military division of West Mississippi, and in January, 1865, was given command of South Carolina. He resigned his volunteer commission in December, 1865, and in 1866, was made a member of the Special Board of Engineers to conduct experiments in connection with the use of iron in the construction of permanent fortifications. He served as superintending engineer of the fortifications on Staten Island, from 1866 to 1869, and also, for several succeeding years, of the works along the Atlantic coast south of New York City. He was made a Lieutenant-Colonel of Engineers, June 13th, 1874, and conducted many notable military enterprises on the Atlantic and Gulf coasts. He was one of the judges at the Centennial Exhibition, in 1876, and was President of the Mississippi River Commission in 1879. He has since then been a member of numerous commissions appointed by the Government for the purpose of making military tests.

The degree of A. M. was conferred on Gen. Gillmore by Oberlin College, in 1856, and that of Ph. D. by Rutgers College, in 1878. He was the author of "*The Siege and Reduction of Fort Pulaski*," of a "*Practical Treatise on Limes, Hydraulic-Cements, and Mortars*," of "*Engineering and Artillery Operations against the Defenses of Charleston*," of "*Béton Coignet, and Other Artificial Stones*," of works on the strength of building-stones of the United States, and on roads, streets, and pavements.

One of his biographers says of Gen. Gillmore's military record: "He made himself the first artillerist of the war, and if not also the first engineer, he was second to none. In the boldness and originality of his operations he surpassed any similar achievements, not only in this war, but in any war. Notwithstanding the varied operations around Richmond, Atlanta, and Vicksburg, when men speak of great living engineers, they think as naturally of Gillmore in the New World, as of Todleben, in the Old."

STREET-WATERING WITH SEA-WATER.



TOFT MONKS, NORFOLK.

WHEN the world and his wife go down to the sea-side in summer they put a heavy strain on the resources of many a quiet town. They consume all the fresh butter and eggs, the milk, and the fruit produced for miles round, and, not least, they reduce the store of water at a speed which costs the local engineer many an anxious hour. They have come in search of health and pleasure, and for both objects they require plenty of water. The morning tub becomes an article of faith with them, even if they neglect it all the rest of the year, and the ablutions of the children are carried out on an unheard-of scale, while, if every atom of dust in the street is not laid, they write to the local paper, and threaten to give the place a bad name in the part of the country from which they come. This extra demand occurs at a time when there is but little rainfall to replenish the reservoir or underground store on which the town relies, and when the flushing of the drains and the watering of gardens is added to the usual requirements of the resident population. Fortunately, it only lasts a short time — so short that it renders the expenditure of large sums for providing storage a very unremunerative proceeding. Under these conditions it is curious that the unlimited sea supply has not been more often drawn upon. Twice a day it comes right up to the town, almost at the street level, and it can be used in the most lavish way without any danger of exhausting the store. For bathing purposes salt water is unequalled, while for such uses as flushing drains and watering roads it might be expected to answer perfectly

well. Unfortunately, the idea was at one time prevalent that for these two purposes sea-water was not applicable. It was demonstrated in the laboratory that the combination of sewage and salt water gave rise to the evolution of sulphuretted hydrogen, and from this it was argued that if it were admitted to the drains it would occasion a foul smell which would be perceived at every gully-hole, and would give the impression that the system of sewerage was defective. On the roads likewise the sea-water was credited with a disintegrating action. Consequently, in most of our coast towns sea-water was not applied to any municipal purpose. In some few, however, the surveyor was more enterprising, and by prolonged trial satisfied himself that none of the evils attributed to the use of sea-water were of any moment if reasonable precautions were observed. In the town of Ryde salt-water has been used for road sprinkling for thirty-five years; and there are several other towns where the practice has been more or less in vogue for some time. Recently the subject has attracted general attention in watering-places, and several schemes have been mooted for the local supply of sea-water. An account of those projects and also of existing works has been compiled by Mr. Stephen Harding Terry, and forms the subject of a paper read by him before the Civil and Mechanical Engineers' Society. From this paper, which is exhaustive of the subject, we learn that there is an almost universal concensus of opinion that salt water is superior to fresh water as a means of laying dust on flint, macadam, and wood roads. The borough engineer of Ipswich, Mr. E. Buckham, addressed inquiries to the engineers of thirty-five coast towns, asking their experience with sea-water. Twelve said that they were employing it, and two were about to build permanent works to render its use possible. Two, only, spoke adversely to its use on roads. The remainder witnessed that it had a binding effect on the surface, covering it with a skin or glaze quite different from the result of fresh-water sprinkling, and so permanent that only about half or one-third as much water was required. The engineer of Ryde, however, stated that too frequent applications of salt water rendered the streets slippery, and that in very hot weather an occasional application of fresh water was needed. In only one place has any complaint arisen in connection with the flushing of the drains, and Mr. Terry suggests that if the drains were foul, flushing of any kind would stir them up and give rise to unpleasant effects. It may, however, be assumed, we think, that when sea-water is used for flushing it should be applied only at suitable times, when it can sweep right through to the outfall, and that it should not be allowed to lie in contact with sewage in a drain which is sealed by the rising tide.

To render the use of sea-water really economical it must be supplied through the town by a system of mains, with hydrants for filling the carts and flushing-tanks. Such works have been carried out in several places at a very moderate cost. At Great Yarmouth they cost 4500*l.*, and consist of an 8 horse-power Crossley gas-engine, a 12-inch pump, a tower and tank containing 22,000 gallons, a settling-tank, and a suction-pipe to the jetty. There are 900 yards of main varying from 3 inches to 8 inches, 40 stand-pipes, and 12 automatic flushing syphons of 2000 gallons capacity each. The total expenses, including interest on capital, repayment of loan in twenty years, depreciation, wages, gas, oil, etc., are under 500*l.* per annum. For this amount some 30 million gallons are raised 44 feet at the cost of 4*d.* per 1000 gallons. Of this five million gallons are used for street watering and 25 million gallons for sewer flushing. The annual cost to the inhabitants is rather less than a penny in the pound on the assessment. The borough engineer states that since the works were completed the saving in purchase of flint and gravel has been 300*l.* per annum, and will be greater. The distribution costs less by 100*l.* a year in consequence of a less volume sufficing, and the roads are better watered, while the flushing of the sewers is well worth the whole cost of the works.

Littlehampton, in Sussex, completed its sea-water works last August. The tank holds 20,500 gallons and can be filled in three hours by a pump driven by a two horse-power gas-engine. There are 900 lineal yards of mains and three drawing-off stations. The cost was 850*l.*, and the total annual expense is 150*l.*, including repayment of loan. This is equal to 1¾*d.* the pound of the rentable value. Hastings has spent 9000*l.* on its work, and the height of the reservoir is sufficient to render the water available for fire purposes.

The experience already gained demonstrates that for an addition to the rates of a penny or two-pence in the pound, a seaside town can put itself into the position of being able to water its roads without stint through the longest and hottest summer, while its sewers may be flushed out most thoroughly. There are besides the collateral advantages of a total saving of the fresh water formerly used for these purposes, of an economy in the upkeep of the roads, and in the attraction offered to visitors of having salt water laid directly to the bath-rooms of the houses. This last is, in itself, a considerable addition to the attractions of a watering-place. There are plenty of people who are wishful to enjoy the bracing effect of sea-water, but who do not care to undress in a ramshackle box on wheels, and disport themselves in scant attire among the waves while an idle crowd on shore while away the forenoon in criticism on their want of agility, and in the threatened obesity of their forms. For strong swimmers and youth of both sexes conscious of possessing good figures, the outdoor bath is full of delights, but the choice of a place to spend the summer holiday lies with the heads of a family who have partly lost their zest for outdoor pursuits, while they are the more eager to conserve their health, since it shows signs of giving way. A domestic sea-water supply would often cause such people to give one watering-place the preference over another.—*Engineering.*

ESTIMATES.

Of all the "royal roads" to learning in popular demand among those connected with architecture and building, none is perhaps more ardently desired than a quick method of estimating. The editor of any architectural journal will know how frequently the question is asked, "How can I estimate the cost of a building without taking the trouble to figure out all the material and labor involved in its construction." The answer is, that there is no way if an accurate estimate be required.

But when it is only desired to obtain an approximate estimate of cost, the method known as "cubing out" is to be recommended. This method is simple, indeed very simple, but it needs not a little judgment and some amount of experience in its application.

Suppose that a building of a certain class costs to erect in a particular location such and such a sum, then a building of the same class and in the same position, but of double the size, would cost approximately double the amount. In other words, the cost of a building is (within certain limits) in arithmetical proportion to its size. This gives the key-note of the principles of cubing out. Having ascertained the cubical contents of a building by measuring from one-half way up the height of the roof to one-half way down the depth of the foundations and multiplying by the length and breadth of the structure, the number so obtained is multiplied by the value of a single foot, and so an approximate estimate of the cost of the whole building is obtained.

It is clear enough that the value placed upon the single unit foot practically determines the whole result. To obtain these unit values in different classes of buildings and in all manner of locations will be the first aim of any one wishing to employ the method. This is best done by figuring on work actually executed. Take, for example, the drawings of several of the ordinary tenement-houses of which the cost is known. Figure out the cubical contents, divide the cost and so obtain the average cost price of the unit foot of such a building. Whenever it is desired to obtain an approximate estimate of the cost of building similar flats, these figures will, by a simple calculation, always give the result. Of course, when there are any special circumstances surrounding the particular case tending either to raise or lower the price as, for instance, local difficulties of construction on the one hand or abundance of materials on the other, due allowance must be made.

The value of cubing out is greater than is ordinarily recognized. The few figures upon which it is based are so easily remembered that it is almost surprising that it is not more widely used. Ninety-nine out of a hundred buildings are designed within specific limits of cost, and to obtain at the outset the maximum capacity in cubic feet will be a material help in the subsequent proceedings.

A good plan is to form a tabulated list of prices obtained by figuring on work actually executed. Thus we might have "flats first-class," "second-class," and so on. Private residences and cottages of various grades, office-buildings, churches and chapels, schools, etc., where deemed advisable a number of columns might be assigned to indicate the cost of the particular description of building in different cities. Arthur Seymour Jennings.

CAROLINA CLAY-EATERS.

It has been a matter of speculation for years as to why the "poor white trash" of central North Carolina ate the clay that is found in that part of the country. It remained for a Philadelphia physician to solve the mystery. A short time ago Dr. Frank H. Getchell, of 1432 Spruce Street, went on a gunning expedition to North Carolina. His quest for game led him into the wild country back of Salisbury, which is inhabited, for the most part, by a miserable race of beings with only just enough energy to eke out a wretched existence. These creatures are nearly all veritable living skeletons, and with few exceptions, are addicted to the habit of clay-eating.

While shooting wild turkey and other game in this wild region, Dr. Getchell made an incidental study of this peculiar habit or vice among the inhabitants. It is a mountainous country, and in the spring little rivulets start out from the caps of snow on the mountain, and as the days grow warmer, the little rivulets become torrents, and great wash-outs are made along the mountain side.

The soil is of a heavy clayey nature, but there are strata of clay that is heavier than the rest, and when the water rushes down, this clay is formed into little pellets and rolls and accumulates in heaps in the valley. These little pellets and rolls are what the clay-eaters devour with as much avidity as a toper swallows a glass of whiskey.

"Among the poor people of this section," said Dr. Getchell, "the habit of eating clay is almost universal. Even little toddlers are confirmed in the habit, and the appetite seems to increase with time. While investigating the matter, I entered a cabin occupied by one of these poor families, and saw a little chap tied by the ankle to the leg of a table, on which was placed a big dish of bread and meat and potatoes within easy reach. The child was kicking and crying, and I asked his mother why she had tied him up. She replied that she wanted him to eat some food before he went out to the clay and he

refused to do so. The woman confessed that she ate the clay herself, but explained that the child's health demanded that it eat some substantial food before eating any earth. Almost every one I met in this section was addicted to this habit. They were all very thin, but their flesh seemed to be puffed out. This was particularly noticeable about the eyes, which had a sort of reddish hue.

"All of the clay-eaters were excessively lazy and indolent, and all of these conditions combined led me to the conclusion that there must be some sedative or stimulating qualities, or both, in the clay, and I determined to find out whether there was or not. I consequently brought a lot of the clay home with me, and Professor Tiernan and myself made an analysis of the stuff, and discovered that, instead of clay-eaters, the inhabitants of central North Carolina should more properly be called arsenic-eaters. All of this clay contains arsenic, but exactly in what proportion we have not yet discovered. Arsenic-eating is common in many parts of the world, and is practised to a greater or less extent throughout the world. It acts as a sedative and also as a stimulant. The mountaineers of Styria, Austria, are habitual arsenic-eaters. They give as their reason for eating it that they are better able to climb the mountains after eating the poison, and their explanation is a perfectly reasonable one, as arsenic acts as a sedative to the heart's action. The habit is also prevalent in the Tyrol and in the Alps.

"It is also said that the peasant girls of Switzerland and parts of Germany and in Scandinavia eat arsenic to give luster to their eyes and color to their cheeks, but this is a matter I have not investigated. It has been shown that arsenic or arsenical fumes are a sure cure for intermittent fever. The inhabitants of a section of Cornwall, England, at one time suffered with this type of fever, but when the copper-works were established there, the fever disappeared. This was accounted for by the arsenical fumes created in the treatment of copper. As to whether arsenic-eating shortens life I am not yet prepared to say, but I intend investigating the matter thoroughly." — *The Clay Worker.*

A CELEBRATED ART MANUFACTURER.

EVERY one knows the pictures of M. Van Beers, and not a few admire them; years ago he painted in the manner of his master Leys, and gave us vivid bits of color, as in his long processional work representing the funeral, I think, of the Emperor Charles V, then, at a later *Salon*, about 1873 or 1874, artistic Paris was enchanted by a boy in yellow and black — powerful, masterly and notable. But although we artists liked these things, they did not impress the public; so M. Van Beers struck out in a new line, and gave us a dainty little lady in pink, sitting on a park bench — I think it was called "Le Soir" — a background of trees, a carriage and pair drawn up in the distance, and a sky reddened by the afterglow, made up a charming little picture, had it not been spoiled by the somewhat *outré* dress of the girl. This picture was a success, attributed evidently by the painter, to the high-heeled shoes and silk stockings, for henceforth M. Van Beers devoted himself to these accessories. Paris talked of nothing but Van Beers's tiny pictures, and Bond Street also took him up. When notoriety waned, an action for slander, against some critic who called his pictures colored photographs, brought him before the public again. Badly hung one year at the *Salon*, Van Beers scratched the face of one of his diminutive damsels, and again he was much discussed. Then, here in London, we had an exhibition of masks, and tambourines, and other conceits, with sprawling ballet-girls in silk stockings and high-heeled shoes appearing upon the backs of sandwich men, and upon all the hoardings. Shillings poured into the coffers, and we felt that here was another type of cant to keep company with Doré's huge canvases, and other peoples' nocturnes, dots, spots and symphonic harmonies. And what is the end of it all? — for let us hope it is the end. Here is the substance of a little tale of a *procés*, taken from *la Flandre libérale* of Ghent, giving charming revelations of the art-manufactory of the great master M. Van Beers.

Finding himself at Ostende, last August, the painter saw some works for sale, which he considered were forgeries of his own. Stupidly bringing an action against the dealer, the evidence at the trial was turned against himself. Two Paris artists affirmed that Van Beers kept some half-dozen painters constantly at work, as his "ghosts." Sometimes he put a few finishing strokes to the pictures, and generally he signed them. The original agreement was that the copyists were to receive half-payment — but this promise was not kept, and the help seem to have been paid like other "hands" in a factory. The atelier Van Beers, situated in Paris, was absolutely nothing but a manufactory of pictures — this is the painter's own admission! and this is the man whose pictures have been the fashion! Colored photographs? who can tell? But it is proved that much, signed Van Beers, is merely the work of Dewit, Semenowsky & Company, with a few finishing touches, and the signature of the putative author.

What a downward path for a man to travel! Excessively clever and original he has turned his cleverness to gulling the public. Not content with vulgarizing his works as advertisements of cigars, he must needs turn picture-making into a mere trade. It is to be hoped that the hanging-committees of all our exhibitions will show M. Van Beers the door in future; but we shall be curious to see in what guise such a master of invention will turn up next time, — for that he is crushed out permanently, there is little likelihood.

The career of Van Beers ought to be a warning to the public; but I suppose it is a vain hope to suppose for one moment, that shams and cant will ever be suppressed. When a painter is the fashion, he may paint boneless and colorless people like Puvis de Chavannes, or stockings and boots like Van Beers, or "dots and spots" like an eminent impressionist; or he may sweep some gray over a canvas and drop a few yellow specks about it and call it a "sonata," and surely every one will declare such works to be charming; but nevertheless, sooner or later, this particular cant gets exposed. That it is succeeded by another craze equally silly, one knows perfectly well; but still it is some slight satisfaction to feel that there is one less master of cant in the world. It is the age of eccentricities, and honest work does not "pay"; still, money is not everything in this world, and one would rather have starved as a Delacroix or a Millet, than have made a fortune as a Van Beers. S. BEALE.

COMMUNICATIONS.

THE AMERICAN PUBLIC HEALTH ASSOCIATION.

STAMFORD, CONN., April 26, 1888.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly give me the address of the American Public Health Association, from whom I presume the pamphlets referred to in your editorial of April 21, 1888, can be obtained? I am much interested in the subjects of these essays and should like to obtain copies of them. Very truly, C. I. PAYNE.

[ADDRESS Dr. Irving A. Watson, Secretary, Concord, N. H. — EDS. AMERICAN ARCHITECT.]

THE COST OF SMALL HOUSES IN PARIS.

BALTIMORE, MD., April 19, 1888.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In your paper of issue 27th of August, 1887, page 94, you refer to items of cost of small Paris house, details of which are published in *La Semaine des Constructeurs*. Will you oblige a subscriber by informing me the date of the issue of *La Semaine des Constructeurs*, in which this article appears, and also where same may be purchased in this country. May I take this opportunity to thank you for your very satisfactory publication and say with what pleasure I have renewed my subscription to the Imperial Edition, although only an amateur. I remain, dear sirs, yours very truly,

CLYMER WHYTE.

[WE are very sorry that we do not keep a long file of *La Semaine des Constructeurs*, and cannot refer to the number. As it probably is not on sale in this country we will say that the bureau of publication is 51 Rue des Ecoles, Paris. — EDS. AMERICAN ARCHITECT.]

MR. TARVER'S THEATRE PLANS.

NEW YORK, N. Y., April 25, 1888.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In the 14th April issue is a clever editorial description of Mr. Tarver's efforts over the vexed theatre problem; based, I should judge, on a perusal of the plans. May I trouble you to advise me where a copy of these and a full description of the scheme can be obtained? thus obliging, Yours sincerely,

GEO. MARTIN HUSS.

[THE plans and description may be found in the *British Architect* of March 23, 1888. — EDS. AMERICAN ARCHITECT.]

BUILDING-MOVERS.

BARRIE, ONT., April 21, 1888.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Please inform me through the columns of your paper, the names of some firms who would undertake the lowering of a brick church, 50′ x 90′ with tower in front about 70′ high. The walls are 25′ high, 18″ thick. The church is situated on a gravel hill and requires to be lowered about 6′. By doing so you will confer a favor on a SUBSCRIBER.

[ISAAC BLAIR & Co., 444 Harrison Ave., Boston, Mass., can handle large work satisfactorily. — EDS. AMERICAN ARHCITECT.]

CATHEDRAL LIGHTING BY ELECTRICITY. — Bristol Cathedral in England, is to be lighted by electricity. It will be used for the first time at a special evening service on June 8th, which is to be held in celebration of the completion of the western towers, when "Israel in Egypt" is to be given with a choir of six hundred voices and full orchestral accompaniment.

NOTES AND CLIPPINGS

The First of Scene-Painters.— Loutherbourg was born at Strasbourg on Oct. 31, 1740, and came of an artistic stock, his father being chief painter to the Prince of Hanaudarmstadt. It was not the intention of his parent that he should follow art as a profession, but the hereditary bias came upon him so strongly while at the local college that his father pocketed his hopes and sent him to study painting under Carlo Vanloo at Paris. The wisdom of this course was speedily exemplified by the young artist's election as member of the French Academy in 1763 —a very signal honor, seeing that in bestowing it the association had infringed upon the rule that no one under thirty years of age should be received into their body. Not long after this Loutherbourg made an extensive tour through Germany, Italy, and Switzerland, painting as he travelled a large number of land and sea scapes and several battle-pieces, which brought him still more prominently into notice. His striking abilities as a battle painter, combined with an appropriate military appearance, earned for him many years afterward the amusing sobriquet of "Field Marshall Leatherbags," to which Jack Bannister stood an unblushing sponsor. Most of Loutherbourg's innovations at Drury Lane were largely due to the powers of observation brought into play during this period of Continental travel. In Italy he saw the practical outcome of the reforms attempted by the two Bibienas (great architects both), to one of whom Algarotti attributes "the introduction of accidental points, or, rather, the invention of viewing scenes by the angle," which, he adds, "produces the finest effect imaginable, but requires the nicest judgment to bring properly into practice." Equally important for us must have been the Parisian influence on the artist. Great attention was now beginning to be paid in the French capital to the hitherto neglected rules of scenic perspective, owing to the labors of the celebrated Giovanni Servandoni, whose services had been first acquired by the Opéra in 1726, and were retained there for close on twenty years. Apart from this the Chevalier was excellently well versed in the intricacies of stage mechanism, and is said, while in Paris, to have constructed a "Temple of the Sun," adorned with "eight thousand jewels set in revolving columns," the like of which, for extreme brilliancy, had never been witnessed before. Some of Loutherbourg's work at Drury Lane shows that he must have made a profound study of this kind of scenery in his early days. It is worthy of mention, however, that Servandoni had a more direct, if obviously slight, influence on the English stage. In praising a fairy palace scene in the Covent Garden pantomime of January, 1774, the *London Magazine* says it was one of those which "Servandoni prepared some years since, but not used." In all probability the Florentine had been induced to paint one or two scenes for the theatres when he came to London in April, 1749, to superintend the construction of the great firework machine erected in Greenwich Park in connection with the rejoicings over the General Peace. He died at Paris in 1766.— *The Gentleman's Magazine.*

Not Taxed since 1085. — Four centuries of exemption from all taxation is a valuable privilege for one family to enjoy. The British paterfamilas who grumbles and pays will hardly credit the existence of a heritage so peculiar, and will certainly not be surprised to learn that this happy family did not exist on English soil. The village of Chalo St. Mard is an obscure place in the vicinity of Etampes, which at a remote period was blest with a fortunate or enterprising *maire*. A legend, for which there appears to be no historic evidence, states that in the year 1085, Eudes, the mayor of Chalo St. Mard, made a pilgrimage to the Holy Land as a sort of proxy for the king, who was too ill to leave home, and in return for the troubles and dangers thus encountered he and his descendants and their families were to be absolved from the payment of taxes. What is certain is that in 1336, the descendants of Eudes renewed their claim, and it was allowed by the Chancellerie of Philippe VI. The document, said to have been signed by Philippe I, and forming the original grant of this singular immunity, was not then forthcoming, but an abstract or account of it was produced and certified as a correct copy or diploma by the Abbots of St. Magloire, St. Victor and St. Geneviève, who were contemporaries of St. Louis, King of France. This passed muster in an uncritical age, and the descendants of Eudes, Mayor of Chalo St. Mard, married and multiplied until they formed an untaxed tribe some thirty thousand strong. The story has just been retold by a French antiquary, M. Noel Valois, who states that this curious historical humbug was decisively detected and exposed by Antoine Marie d'Hozier in the middle of the last century. But the *ancien régime* was drawing to its close when in 1752 the exemption ceased. For at least four centuries a baseless fiction influenced even the unsentimental tax-farmers of France, and during the same long lapse of years the overtaxed citizens had the opportunity of contrasting the extortions to which they were subjected with the immunity enjoyed by the children of the Mayor of Chalo St. Mard and all who had the honor of kinship and alliance with them.— *Exchange.*

TRADE SURVEYS

No pronounced improvement has as yet set in in trade or manufacturing circles, according to the usually-quoted commercial authorities. There is unusual activity in various side channels not reported. What the trunk lines are doing this week, what the clearing-house reports are for the past six days, what the totals are in various staple products at distributing centres for the week, may be interesting reading, but they do not represent the actual trade and commercial conditions. The stock and bond speculators are counting unhatched chickens, manufacturers are figuring out future business, railroad projectorsare counting on the employment of millions of dollars that will yield dividends in a year or two, land speculators are anticipating great sales to new comers at high prices, and agricultural, mining and lumber and other interests are looking forward to a season of increased activity that will bring them larger volumes of business and better margins. At no time in the history of the country has as large a stream of capital sought employment in reproductive channels as now. To-day's earnings disappear in to-morrow's loans. The country is living economically and is avoiding inflated values in every direction. Overproduction is also avoided and an intelligent control is exercised in every branch of business, productive and distributive. So far as national legislation has gone, there is nothing to cause the great producing interests any concern. It is now more generally and more clearly recognized than it was a few years ago that an abundant supply of money is the prime requisite of industrial, commercial and financial health, and the feeble efforts made by the old school of lawmakers to run the business of the country on a gold basis make no impression against the powerful public sentiment, backed by business interests, that demands an abundance of the best money that our circumstances allow us to have and use. No financial policy has yet been mapped out and no vigorous efforts will be made very long in advance of actual requirements. Business men, manufacturers, builders, all are deeply concerned in the establishment, at the earliest day possible, of a financial as well as of a sound fiscal system which will satisfy the country. The natural process of decay will soon force a new financial system upon us. The purely money-lending interests will seek to gain vantage grounds they could not occupy when the present system received its birth in the throes of civil war. There is now no war, there is no other pressure than a purely business one on us to devise and adopt a sound system. There is danger of making a mistake because the money-lenders are few, united, keen and far-seeing, the masses whose future material interests are to be affected in the choice of a system or basis are uninformed, unorganized and indifferent. A right system of finance will open up a grand future, a wrong system will precipitate a depression and panic as soon as the economic heresies adopted in the furtherance of selfish interests can work their way to the vitals. The gold idea would in time double the present enormous individual indebtedness of the people to money-lenders without conferring any corresponding advantage. That an attempt will be made to foist a grinding and oppressive financial system upon us cannot be doubted by the student of our history for fifty years past or even by the observer of current events at Washington. The proper basis of our future monetary system will soon become the absorbing one among the leading minds on both sides of the question. Every week confirms the often-repeated statement that the brakes are being tightened on the wheels of trade. In iron, consumption is away behind. In coal the per capita consumption is not as large as last year, although the anthracite output is two days ahead of last year. So far this year the distribution of bituminous coal is one week ahead of last year in Eastern markets. In Southern markets coal and coke are in urgent demand. In Western markets demand is slack, and upwards of seven thousand workers in the Connellsville region are idle. There is great activity in the construction of lake craft and docks and wharves are to be built all along the lakes from Buffalo to Duluth to multiply the facilities for rapid shipment. Much new bridgework is projected across the Western and Northwestern rivers and Pennsylvania iron-makers who keep informed in this direction estimate that bridgework will be quite plenty during the last half of the year. The car and locomotive builders are crowded. Rail-mill owners look for orders aggregating 200,000 tons to drop in on them within thirty days after the defeat of the pending tariff bill. Agents for elevator-work in the Northwest, for electrical plants, water and gas works, for mining, flooring and lumber mill machinery have returned home within a week or two with even larger orders than were secured last year. On the other hand, several Eastern and Western trunk lines will discharge all the help they can dispense with, but so far as can be learned this week there will be no serious curtailment of manufacturing activity. Cotton mills will run as usual. The output of textile goods in general will be larger during the last half of the year than the first half. More heavy machinery is now under contract than ever. The labor question has assumed a more satisfactory shape. The fever of organization is subsiding and a clearer perception of the inutility of strikes, except in extreme cases, is recognized. The educational scheme will not be satisfactory for several reasons, one being the unwillingness of members to listen to anything but what suits them. Arbitration is less in favor. More aggressive measures will be demanded later on and strikes will once again be the popular means of advancing labor's cause. This reaction is probable within two years. The scattering of skilled labor in progress also helps to decrease the striking tendency for the present, but should a depression overtake the country the present conservative methods of labor management would be thrown to the winds. Lower rates of compensation will be established in several industries, especially in the West, where the expansion of capacity will not keep pace with the record of two or three years past. Labor leaders see that with the more complete organization of employers to contend against, their wiser policy lies in conservative methods. The secret of the advantage recently secured by employers is due to the expansion of producing capacity beyond current wants. Any industry can idle fifteen to twenty per cent of its force and thus bring labor to terms. Capital's disadvantage for a year or two past was due to the fact that it was necessary to keep every wheel turning. The situation has been reversed. Manufacturing interests find it cheaper in the long run to be able to suspend ten per cent of their labor force, even though a portion of their machinery remain idle, than to run to full capacity at wages virtually dictated by labor. Only second in interest to labor probabilities at this time is the question of prices. That there will be a reaction no one doubts. Bottom prices were looked for this month. Manufacturers East and West write and say bottom has not yet been reached. The only visible effect produced is greater curtailment. Failures are not increasing. Neither is mortgage indebtedness. Lumber manufacturers will make and ship more lumber than last year. The country trade is absorbing more than its usual average and Southern mills are increasing their production faster than Northern. Prices are firm but dealers along the coast argue lower prices will result from the great increase in output. This is guesswork. No one can measure the probable demands. Every farmer is a better customer than a few years ago, and the increased demand for building material and staple household products in rural localities may be safely estimated at double the volume of three or four years ago. Statisticians overlook this source in estimating probabilities of trade. Reports from one hundred and seven railroads show an increase in earnings from seventy to seventy-two million dollars for the first quarter of the year over first quarter of last year. Reports from Maine and Delaware River-shipyards indicate a busy half year from July 1st to make up for severe losses of schooners and small craft along the coast and Gulf. Ship timber and ironwork for ships have been contracted for in Pennsylvania quite liberally within the past month.

S. J. Parkhill & Co., Printers, Boston.

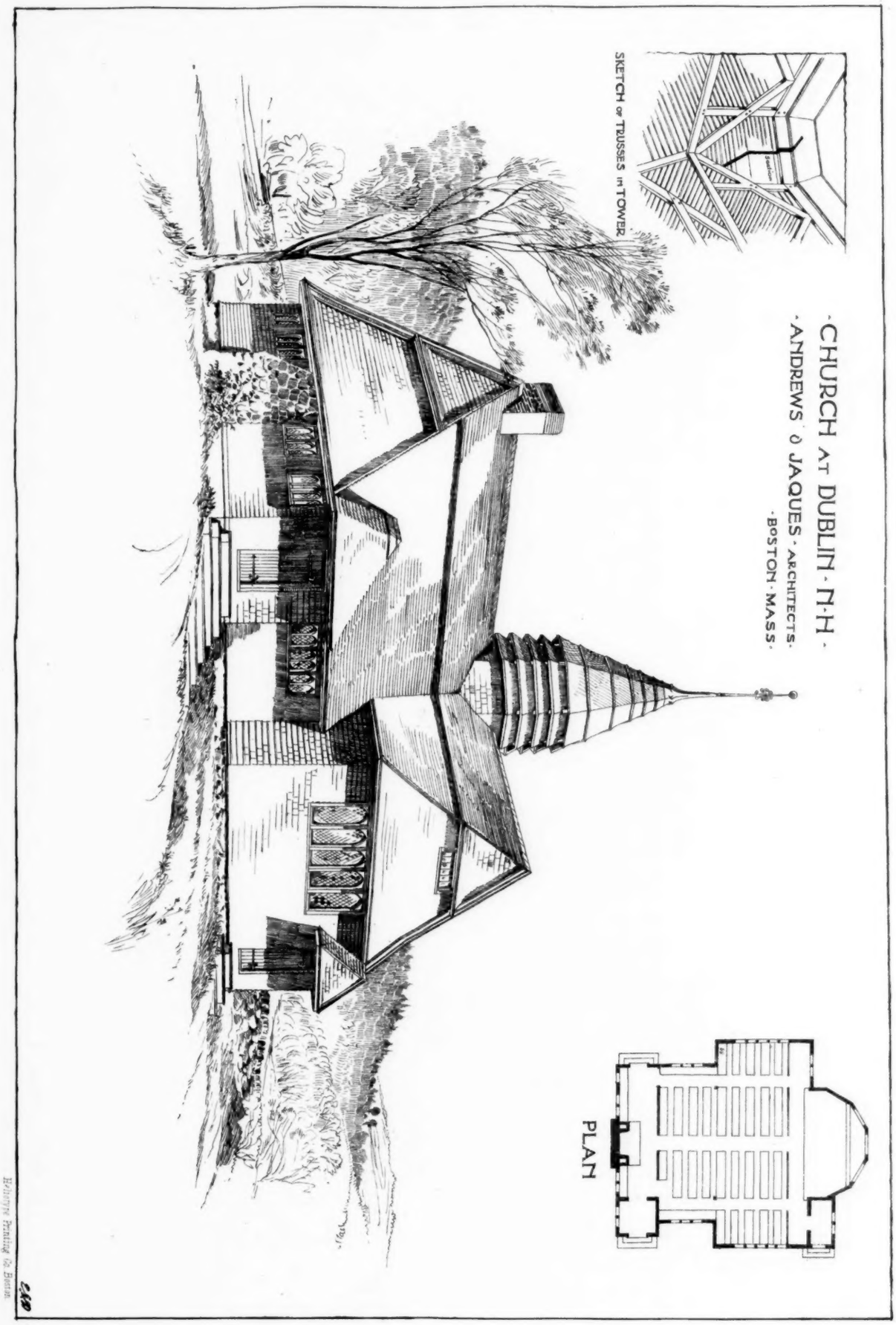
COPYRIGHT 1888 BY TUCKNOR & Co

STUDY FOR A STORE BUILDING
AT ST. PAUL · MINNESOTA ·

· GILBERT AND TAYLOR · ARCHITECTS ·

Heliotype Printing Co. Boston.

COPYRIGHT 1888 BY TICKNOR & CO



Heliotype Printing Co. Boston.

COPYRIGHT 1888 BY TICKNOR & CO

Heliotype Printing Co. Boston.

BUILDING FOR THE "PIONEER PRESS" ST. PAUL, MINN.

COPYRIGHT 1888 BY TICKNOR & Co

PLANS for APARTMENT-HOUSES,

EACH HOUSE TO BE ONE OF A PAIR OR SERIES;

ON LAND LAID OUT AS IN NEW YORK, IN LOTS 25 FEET FRONT BY 100 FEET DEEP; AND

CONTAINING EQUIVALENT TO

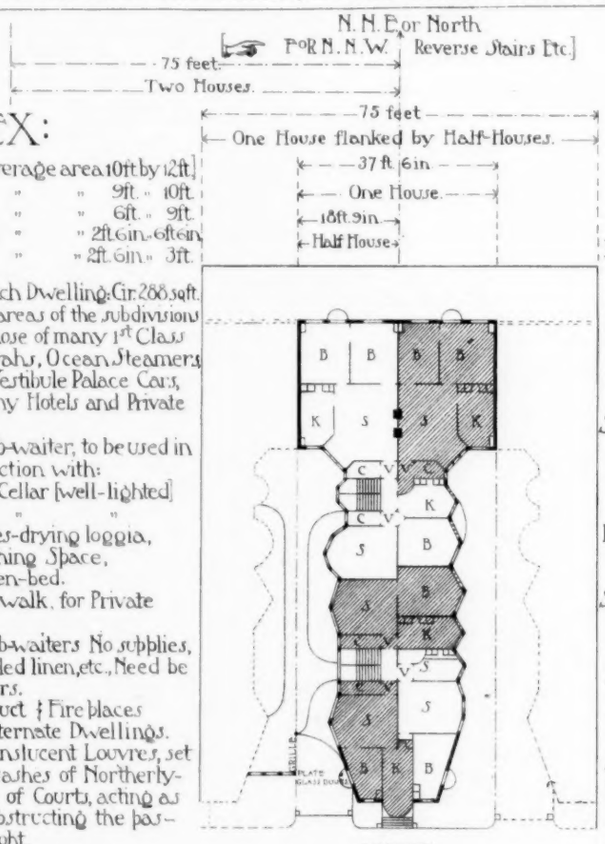
FOUR DWELLINGS ON EACH FLOOR ON EACH LOT; EACH HOUSE ON ONE LOT AND A HALF;

ARRANGED ON E. T. POTTER'S SYSTEM FOR GROUPING DWELLINGS [FOR RENT OR SEPARATE OWNERS,]

WITH LEAST LOSS OF LIGHT, AIR, PRIVACY, THOROUGHDRAUGHT, SUNSHINE, ETC.

[Ten feet of the rear of each lot is left open as, in New York, required by Law.]

EACH HOUSE, ON EACH FLOOR, CONTAINS SIX DWELLINGS, VIZ: FOUR DWELLINGS OF THREE ROOMS EACH, & TWO DWELLINGS OF FOUR EACH.



INDEX:

S. Sitting Room. [average area 10ft by 12ft.]
B. Bed Room. " " 9ft. " 10ft.
K. Kitchen. " " 6ft. " 9ft.
C. Closet and Bath. " " 2ft 6in. 6ft 6in.
V. Vestibule. " " 2ft. 6in. " 3ft.

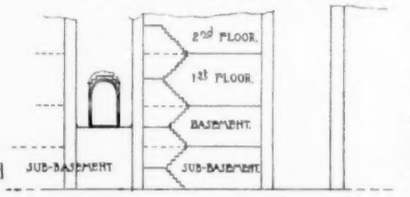
Average area of Each Dwelling: Gr. 288 sq ft.
The very limited areas of the subdivisions are not less than those of many 1st Class Yachts, Dahabeeyahs, Ocean Steamers, Trains de Luxe, Vestibule Palace Cars, Etc., or than of many Hotels and Private Houses.

Private Small Dumb-waiter, to be used in connection with:
" " Food Cellar [well-lighted]
" " Fuel " "
" " Clothes-drying loggia,
" " Bleaching Space,
" " Garden-bed.
A room under Sidewalk, for Private Ash-cans.
By using the dumb-waiters No supplies, Refuse, Wet or soiled linen, etc., Need be carried on the Stairs.

Balcony = Air-duct ‡ Fire places
Wisteriae // Alternate Dwellings.
zzz Fixed vertical translucent Louvres, set on the outside of sashes of Northerly-facing windows of Courts, acting as Screens; but not obstructing the passage of air or light.

Thoroughdraughts at Command through Every Dwelling.
Sunshine exposure: One hour or more daily of Every Dwelling.
Shade: Draw-up Blinds outside southerly windows; Awnings over Courts.
Quiet is furthered by the absence of passages, the Enclosing of Entrance-Corridor, etc.
Outlook: Nearly equally Cheerful for each dwelling.

[The Sea Breeze, usually prevailing in New York on summer evenings, can enter each dwelling.
Overshadowing by Neighboring buildings is slight; that by this building will depend on its height and distance off.
All stairs to be full width throughout, and roofed in with glass: Entrance-Corridor to be enclosed with stained glass; a blanket of low growths on its roof [to deaden sun-glare].



SECTION OF ENTRANCE, CORRIDOR, ETC.

The Widths of Frontages most common in New York are:

12ft 6in. 12ft 6in. 16ft 4in 16ft 4in. 16ft 4in 18ft 9in 18ft 9in 18ft 9in 18ft 9in 20ft. 20ft 10in 21ft. 5½in Etc.
25ft. 50ft.
1/5 of 100ft 1/6 of 125ft 1/7 of 150ft Etc.

Copyright 1888 by E. T. Potter.

NOTES:

Fire-Escape to Street and to Roofs of adjoining Houses by Incombustible Stairs and Passages.

Insurance = By carrying party-walls well above house-tops; making all partitions, however thin, Incombustible [as in Paris]; Floors practically fire-proof; as in Florence; Using no wood for Stairs, unnecessary Trim, etc. Such buildings can be economically made Strong, Pleasing and Lasting, and Insurance Reduced.

Separate ownership of the Separate Dwellings grouped under one roof, opens profitable Proprietorship of Real-Estate to All who to small earnings add Industry and Thrift.

Erecting such groups of Dwellings is made easy by Building Associations, in which owning of Real-Estate is acquired by Small Weekly Payments.

Ready Sale, at fair prices, of such Dwellings, will be helped in proportion to their Attractive Situation, Exterior, Entrance, Finish, Convenience, Cheerfulness and estimated Healthfulness; the Respectability of Occupants; their Small Cost from Small Size; and an absence of indications of Class Distinctions.

In Investments in Real-Estate, a small sum invested in land to secure good light and air, will often bring in a better Return than a larger sum used in additional building which shuts out light and air.

By the Plans and Methods here indicated, the fullest number of families usually housed on New York lots are accommodated on an Equal Area, and the other main advantages of the New York Street and Lot System are retained, while the main evils generated by that System are avoided.

THIS PLAN IS SUITED TO LOTS RATHER WIDER OR NARROWER: BUT, ON NARROWER LOTS THE COST OF BUILDING WOULD NOT DIMINISH SO MUCH AS THE SIZE OF THE DWELLINGS, NOR WOULD THE INTEREST ON COST OF LAND SO SAVED PROBABLY EQUAL THE LOSS FROM THEIR DIMINISHED VALUE. WIDER LOTS WOULD GIVE LARGER ROOMS ETC; BUT NOT THEN COULD SO MANY FAMILIES LIVE ON THE SAME AREA OF GROUND.

Heliotype Printing Co. Boston

COPYRIGHT 1888 BY TICKNOR & CO

DESIGN FOR
CONGREGATIONAL CHURCH AT
ELIZABETHTOWN N.Y.

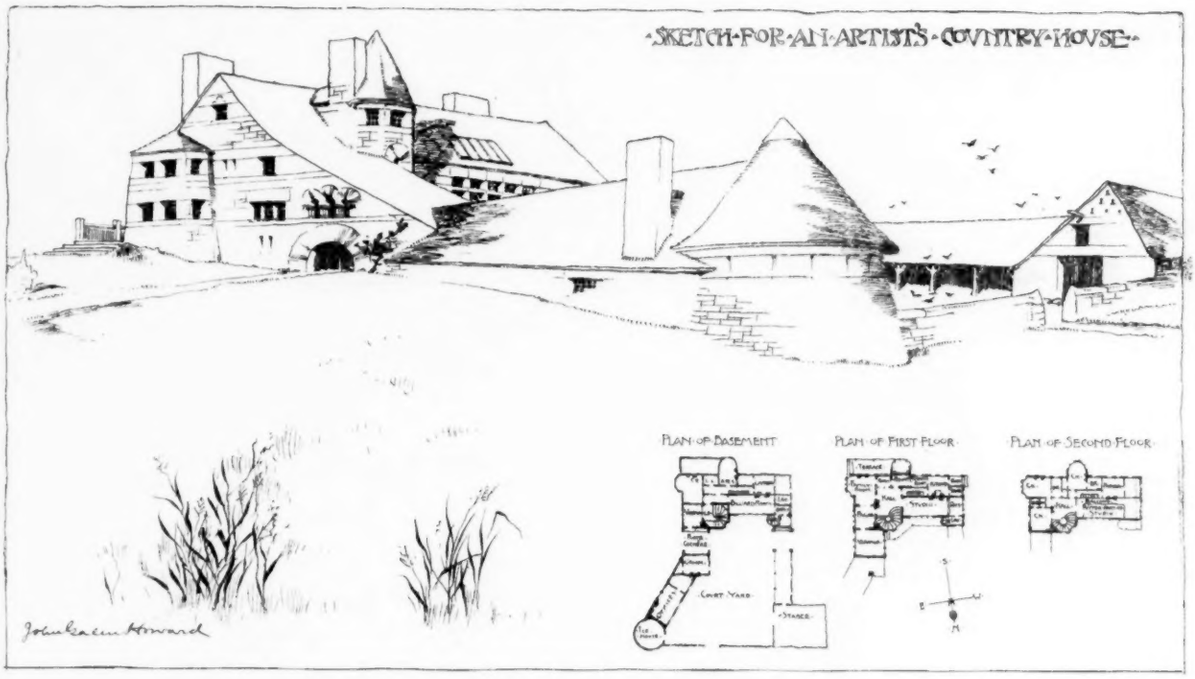
R.W. GIBSON ARCHT ALBANY N.Y.

FROM NORTH WEST

Heliotype Printing Co. Boston

COPYRIGHT 1888 BY TICKNOR & CO

SKETCH FOR AN ARTIST'S COUNTRY HOUSE.



Heliotype Printing Co. Boston.